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RESEARCH AND FARMING

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SEVENTY-SECOND ANNUAL REPORT
North Carolina Agricultural Experiment Station

North Carolina State College of Agriculture and Engineering
of the
University of North Carolina
Raleigh

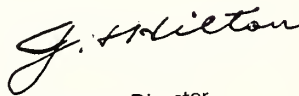
SCHOOL OF
AGRICULTURAL AND FORESTRY
RESEARCH EXTENSION
RESIDENT TEACHING
AGRICULTURAL EXPERIMENT STATION

OFFICE OF DEAN AND DIRECTOR

To. The Governor of North Carolina
The Board of Trustees and President of the University of
North Carolina
The Chancellor of North Carolina State College of Agriculture and Engineering

I am transmitting herewith the report of the Agricultural Experiment Station for the year ending June 30, 1949.

Respectfully Submitted,



J. H. HILTON, Director

RESEARCH AND FARMING

SPRING, 1950

VOLUME VIII
PROGRESS REPORT NO. 4

SEVENTY-SECOND ANNUAL REPORT

Agricultural Experiment Station,
North Carolina State College of Ag-
riculture and Engineering of the Uni-
versity of North Carolina. Fisco-
Period of July 1, 1948 to June 30,
1949. Progress for December 1, 1948
to November 30, 1949; North Caro-
lina Department of Agriculture, Co-
operating.

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Dean and Director

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Ralph Mills

ART WORK
N. S. Youngsteadt

ON THE COVER: Soil augers
are the tool-in-trade of the soil
surveyor. This auger has just
been used to "pull" a sample
in the Duplin County survey
(See Page 52).—Photo by Ralph
Mills.

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LIVESTOCK AND POULTRY

"Proved Sires" for the Beef Herd?

The importance of using good sires in a dairy herd has been so well established that the "proved sire" method of breeding has become standard. Less is known about the improvement of beef cattle through breeding.

A comparison between two purebred Hereford bulls on grade Hereford cows at the Tidewater Experiment Station from 1941 to 1948 contributes to knowledge on this subject. The aim of W. C. Godley and H. A. Stewart in making this study was to determine whether there was a difference between these bulls (1) in the weaned weight of their calves; (2) the rate of gain of their steers in the feed lot; (3) the total gain of their daughters from weaning to the end of the first pasture season; (4) the slaughter grade of the steers; and (5) the weaned weight of the calves of the daughters.

Bulls used in the tests were N. C. State Lad II and Bill Domino. Calves sired by N. C. State Lad II were 14 pounds heavier than those by Bill Domino. Steers sired by these bulls showed no differences in their rate of gain in the feed lot. However, the daughters of N. C. State Lad II gained an average of 19 pounds more during their first year after weaning than those of Bill Domino.

The calves of the daughters of N. C. Lad II were 45 pounds heavier at weaning than those from the daughters of Bill Domino. The steers sired by Bill Domino were graded an average of one-third of a slaughter grade above those sired by Lad. This indicates a slightly higher value per pound on the hoof. Stewart and Godley think it is doubtful that this increase in value would offset the additional pounds of product sired by N. C. State Lad II.

In this study, the bull calves weaned at an average of 27 pounds more than the heifers. There was no relationship between the initial feed lot weight and rate of gain. Neither did the rate of gain in feed lot affect the slaughter grade of the steers.



This heifer is from a grade Hereford cow bred artificially to a Romo-Sinuano bull. The semen was flown to Raleigh from South America.

South American Bull Sires Calf at Station

A heifer calf born June 5, 1949 at the Animal Husbandry farm near Raleigh marked the beginning of a national effort to breed better beef cattle through the introduction of new germ plasm into this country. The calf's mother was a grade Hereford, her father a Romo-Sinuano bull located at the National Livestock Station at Monteria, Colombia.

The North Carolina Experiment Station as a participant in the National Beef Cattle Breeding Project was selected to start the program. H. A. Stewart, E. U. Dillard and E. H. Hostetler were placed in charge.

During 1948 six shipments of semen collected at the Monteria Station were flown to Raleigh to inseminate grade Hereford cows. Because of delays en route only three of the shipments were alive on arrival, and two of these were of doubtful value. The heifer calf was the first offspring of these inseminations.

During the spring of 1949, 17 shipments were received at semi-weekly intervals. Of the 21 cows

showing normal estrus during the period of insemination, at least 33 per cent settled to their first service.

Romo-Sinuano cattle are a docile, polled beef breed being developed by the Colombian Government. They are a solid golden red color with no white markings. Their skin is black, and the hair is dense and short. They appear to be adapted to high temperatures and can withstand the many insect pests of Colombia's northern coastal plain region.

In another crossbreeding experiment, Brahman X Hereford calves averaged 29 pounds heavier than Africander-Hereford crossbreds and 37 pounds heavier than grade Hereford calves at weaning times. The 137 calves involved in this study were sired by Brahman, Africander and Hereford bulls and carried to weaning by grade Hereford cows grazing on the Hoffman Forest.

The cows' weight rather than their frequency of calving was reflected in the weaned weight of their calves. These studies were conducted by T. J. Marlow and H. A. Stewart.

PASTURE STRIPS SERVE AS FOREST FIREBREAKS



One of the pasture strips used as firelanes in the Plymouth experiment.

The possibility of using strips of improved pasture as firebreaks in high-hazard forest types of the Coastal Plain is being explored at Tidewater Experiment Station and the Frying Pan Experimental Range by W. O. Shepherd, R. H. Hughes, E. H. Hostetler, E. U. Dillard, and J. L. Rae. To be effective, such a method of fire control requires a "sod" of pasture plants which will prevent inflammable weeds and other native vegetation from growing. At the same time, the sod itself must constitute a fire barrier by being green or closely grazed during the fire season.

Studies were started in the fall of 1948 to investigate ways of constructing such firebreaks and pasture species suitable for this use. Lanes 18 to 36 feet wide have been constructed. Some with ditches at the sides are slightly crowned in the center while others are flat and unditched. The Mathis fire plow, bush-and-bog harrow, Marden rotary brush cutter and a road grader were the implements used.

Both the bush-and-bog harrow and the rotary brush cutter were found to be effective for preparing a seedbed in moderately brushy land. Where the brush is very large and thick, the Mathis fire plow fol-

lowed (several months later) by a bush-and-bog harrow is an effective procedure.

Ditching and slightly crowning the lanes (with the fire plow and the road grader) proved to be highly desirable in flat, poorly drained sites. The unusually heavy rains during the summer of 1949 flooded these sites for long periods and killed many of the pasture plants on level lanes. The slight crowning and ditching not only prevented drowning out, but when once packed down, these lanes remained firm and resistant to trampling damage even in the wettest weather. In dry fire weather such lanes would serve as emergency roads through the forest.

Four grasses (redtop, alta fescue, Dallis grass, and annual rye grass) and four legumes (Ladino clover, big trefoil, subterranean clover and Kobe lespedeza) were tested in several hundred plots on the lanes. They were under continuous heavy grazing during 1949.

Redtop maintained a particularly dense turf and most effectively controlled weed invasion. It followed by alta fescue in these respects. Dallis grass was slow to establish and did not form a sod during the first year. Annual ryegrass made excellent growth the first season but failed to reseed adequately under heavy grazing.

Going into the second year Ladino clover had the best stand of the clovers. Only moderately successful stands of big trefoil and sub-clover were obtained, but all three species show considerable promise for this use. Kobe lespedeza made good growth, but it did not reseed well. In addition, this species is dead and dry during the fire season of late winter and early spring.

The lanes were not inflammable the first year. Apparently they will continue to be effective firebreaks where the sod prevents weedy growth and is green or closely grazed in winter and spring.

To date, redtop has provided the best sod, but it has also suppressed associated legumes. Ladino or white Dutch clover and big trefoil are the most promising legumes tested.

Blood Copper Level Low in N. C. Animals

The fact that some livestock in the Coastal Plain area of North Carolina do not have enough copper in their blood may mean that the native vegetation of this area is deficient in copper.

A research team consisting of H. M. Baxley, Gennard Matrone, W. J. Weybrew and G. H. Wise has been investigating the copper status of eastern Carolina livestock for the past four years. While the findings are still inconclusive, farmers will find them interesting.

A small amount of copper as well as iron is needed to form hemoglobin in the animal body. Iron may be absorbed and stored for later use, but unless there is enough copper in the feed, the animals suffer from anemia.

Using the amount of copper in the serum as a measure, the investigators made tests with dairy cows and swine in the State College herds, with native milk cows in the Coastal Plain, with beef cattle in the Hoffman Forest area and with sheep at the Tidewater Experiment Station.

They report that the blood serum copper of swine is over 100 per cent higher than that of other classes of livestock studied. This leads to speculation that the copper requirement of swine is higher than that of other types of livestock. Since corn is low in copper, it is possible that swine on high corn rations do not get enough copper.

Among the cattle and sheep tested, only the College dairy herd approached what was considered a normal level in the copper serum tests. In contrast with this was the low level of copper nutrition found in the beef cattle of Hoffman Forest and the native milk cows of the Coastal Plain.

The research team has not yet determined whether a low level of copper nutrition affects the animal production. They did observe during these studies that the beef cattle were in poor physical condition and that reproduction failures were high.

Does Fertilization Improve Nutrition?

Today, the farmer is as much concerned with the effects of fertilizers on the nutritive value of his crops as he is with the effects on yield. His interest stems from indications that the nutritional quality of crops directly affects the productivity of farm animals and indirectly affects the health of our people.

In line with this reasoning, a research team headed by Gennard Matrone is conducting long-term experiments with sheep at the Tidewater Experiment Station and at the Central Station near Raleigh. Their purpose is to find out (1) if the use of phosphate fertilizer on soil low in phosphorus will improve the health and productivity of successive generations of sheep fed crops grown on this soil; and (2) if applying phosphate fertilizer to a soil low in this element will change the nutritive value of crops grown thereon.

In this study, the sheep have access to a year-around pasture rotation consisting of soybeans, rye grass and lespedeza. Lime and potash are added to all pastures, but phosphate is added to only half of them. When necessary, the grazing is supplemented with corn and soybean hay—both grown under the same fertilization treatment as the pastures.

During the two years thus far, the investigators have found no conclusive differences in the health and productivity of sheep in the

two groups. But differences in the nutritive value of the soybean hays receiving these treatments were found during the third-crop year.

In this phase of the experiment, the hay was analyzed and tested in controlled feeding experiments and digestion trials using lambs and rabbits. From these tests it became evident that when the levels of phosphorus in the soil were extremely low, phosphate fertilization changed the nutritive value and chemical composition—especially in phosphorus and crude protein content. Fertilization increased the yield of soybean hay by two- or three-fold and improved the nutritive value of the hay for lambs and for rabbits.

The factor causing the dietary difference for sheep appeared to be the extra phosphorus in the fertilized hay. The factors causing the differences in the rabbit trials were not discovered. No evidence was found to indicate that phosphate fertilization altered the availability of the phosphorus or the protein quality of the soybean hay for either rabbits or lambs.

It must be borne in mind, however, that the results were obtained at a relatively low level of phosphate fertilization under conditions of extreme soil phosphorus depletion using one forage species. The effects of a wider range of phosphate fertilization on soybeans and other forages are yet to be determined.

LADINO PRODUCES 136 POUNDS OF LAMB PER ACRE

Ladino clover-fescue pasture produced an average of 136 pounds of lamb per acre in winter grazing trials at the Animal Husbandry Farm near Raleigh. Lambs in the experiments gained an average of 0.22 pounds per day.

E. R. Barrick, W. W. Woodhouse, Jr., F. H. Smith and H. L. Lucas undertook the test to determine the amount of winter grazing that can be expected from Ladino-fescue pasture. The pasture used had been established in the fall of 1948. It was grazed from the spring of 1949 until October 1, 1949. Then grazing was deferred to permit some forage

to accumulate before the experiment was started November 15.

Twenty pasture plots, each about 0.28 acre in size, were grazed continuously with grade Hampshire feeder lambs. The pastures were stocked at the rate of seven feeder lambs (approximately one animal unit) per acre.

All of the plots provided continuous grazing until February 1, and some carried the animals until February 16. The rate of gain was somewhat higher for the first 60 days (0.28 pounds per lamb per day) than for the latter part of the grazing period.

Fertilization Alters Composition of Plants

Applications of phosphate fertilizer were found to alter the chemical composition of several plants grown on soil low in phosphorus, according to F. W. Sherwood. Sherwood heads a research team investigating the effects of phosphate fertilization on such crops as soybeans, corn, oats and rye grass.

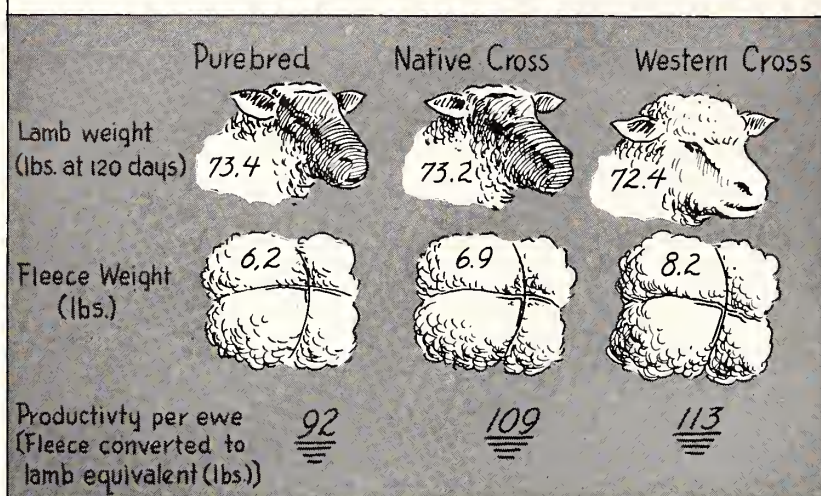
Fertilization of soybeans with phosphorus increased the content of phosphorus, crude protein, calcium and magnesium in the hay. The carotene and riboflavin contents of air-dried leaves were also increased by fertilization. But since some of the carotene in leafy material is lost during drying, it is not certain that fertilization affected the carotene content on the fresh material basis.

The proportion of leaves, pods and stems was not influenced significantly by fertilization. However, the mean weight of individual plants receiving phosphorus was two and a half times as great as those without phosphorus in the 1947 hay crop. The leaves which made up only about a fourth of the total weight of the plants contained 93.4 per cent of the total carotene, 62.7 per cent of the total riboflavin, 38.2 per cent of the protein, 37.7 per cent of the calcium, 21 per cent of the magnesium and 32.1 per cent of the phosphorus.

The pods, amounting to about 20 per cent of the total weight, contained 37.6 per cent of the phosphorus, 29.9 per cent of the total crude protein, 19.5 per cent of the calcium and 21 per cent of the magnesium. The stems which were 54.2 per cent of the plant contained 30.3 per cent of the phosphorus, 31.9 per cent of the crude protein, 42.8 per cent of the calcium and 58.1 per cent of the magnesium in the plant. These were the values for the phosphated hay, though those for the non-phosphated hay were similar.

Phosphate fertilization of corn grown under the same conditions as the soybean hay increased the phosphorus content of the corn slightly. The protein, however, was unaffected.

CROSSBRED vs. PUREBRED



CROSSBRED EWES EXCEL PUREBREDS

During the past two years, many North Carolina farmers have bought Western ewes for starting or expanding their farm flocks. Their purchases have led to considerable discussion as to the relative merits of western and local breeds of sheep.

An experiment being conducted at the Upper Mountain Experiment Station by Lemuel Goode, H. A. Stewart and J. A. Graham is shedding some light on this and other sheep breeding problems. The scientists are comparing three systems of breeding: (1) mating purebred Hampshire ewes to purebred Hampshire rams; (2) mating native Hampshire ewes to rams of mutton

breeds in rotation; and (3) mating crossbred western ewes to purebred Hampshire rams.

A summary of four years' results shows that both the western and grade Hampshire ewes have weaned more lambs than the purebred Hampshires. As indicated in the accompanying figure, lambs from western ewes weighed slightly less at 120 days of age. But fleece weights for western ewes averaged two pounds heavier than those from purebred Hampshires.

Goode and his associates computed total ewe productivity by converting fleece weight to lamb equivalent.

COW'S COLOSTRUM BEST SUBSTITUTE FOR BABY PIGS

Many farm families have tried the difficult task of hand-feeding newborn pigs that either could or would not be fed by their mother. Failure is common in such cases, since few pigs live that do not have access to sow's colostrum.

North Carolina workers have previously reported success in rearing pigs removed from their dams at three days of age. In fact, growth rates of these pigs reared on fortified milk diets have been superior to those of nursing pigs.

The latest experiments, conducted by E. R. Barrick, G. Matrone, H. A.

Stewart and G. H. Wise, involve pigs removed from their dams at birth. Five different diets were used, with either cow's colostrum or fresh cow's milk as the basis of each. All diets were fortified with minerals and vitamins A, D, and C.

The number of pigs used to date has been too limited to be conclusive. However, the cow's colostrum has given the best survival—approximately 70 per cent. The surviving pigs averaged 24 pounds in weight at five weeks of age. Several of the pigs developed muscular and leg abnormalities,

Supplements Improve Cottonseed Meal Value

Cottonseed meal is one of the South's most abundant protein supplements for livestock feed. Yet swine growers have not been able to use it as their main protein supplement because it is sometimes poisonous to hogs.

In addition, plant protein concentrates alone have not been a satisfactory supplement to corn. Only since animal protein factor concentrates became available has it been possible to get normal growth and fattening on rations made up of corn and peanut meal.

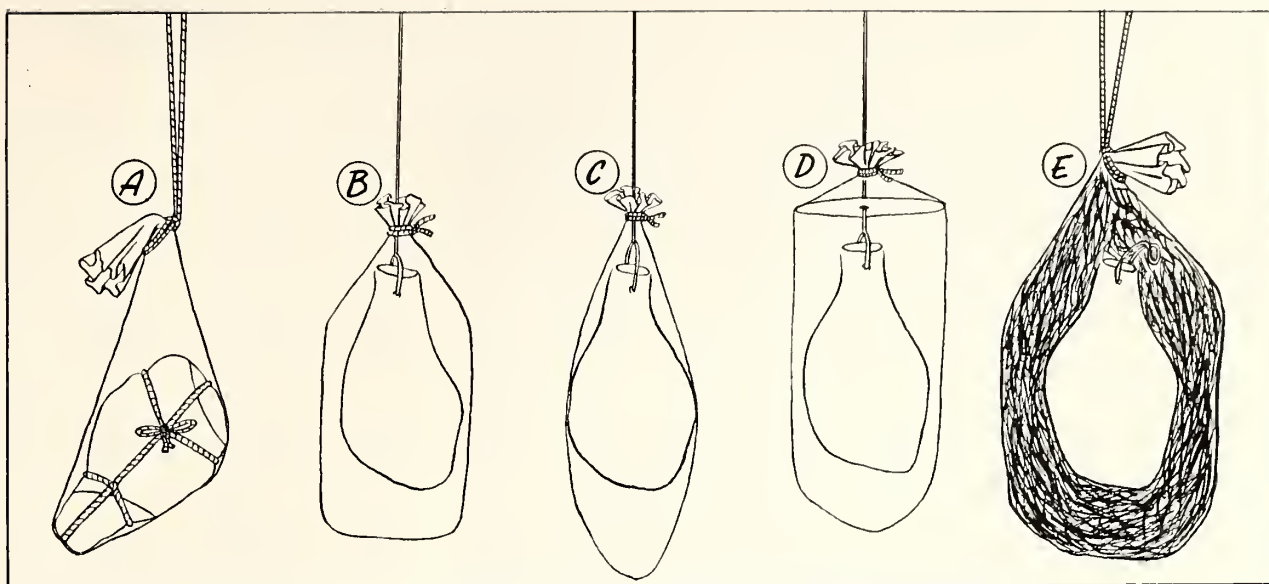
E. R. Barrick, H. A. Stewart, G. Matrone, F. H. Smith, E. H. Hostetler and G. H. Wise are exploring the possibility of improving cottonseed meal as a supplement for growing and fattening hogs. Previous experiments had shown that treating cottonseed meal with ferrous sulfate aided in overcoming the toxic effects.

In these exploratory tests, animal protein factor and ferrous sulfate were used separately and in combination as supplements. The basal ration consisted of corn, cottonseed meal, alfalfa meal, minerals and riboflavin.

Results for the first six weeks showed a definite growth advantage for the addition of animal protein factor and ferrous sulfate. Pigs on the basal cottonseed meal ration made an average daily gain of only 0.25 pounds. Those receiving the ferrous sulfate in addition averaged 0.58 pounds of gain per day, while those receiving animal protein factor averaged 0.60 pounds. Where the combination of animal protein factor and ferrous sulfate was used, average gain was 0.86 pounds daily.

Similar pigs on a mixed protein supplement of meat scraps, soybean meal and cottonseed meal gained an average of 1.48 pounds per pig per day for the six-week period.

In view of this latter comparison, Barrick and his associates conclude that the ferrous sulfate and animal protein factor concentrate at the rates used did not correct all the limitations of the corn-cottonseed-meal-alfalfa meal ration.



These drawings illustrate the methods tested for protecting hams from skipper flies.

PROTECT HAMS FROM SKIPPER FLIES

Several devices tested for protecting hams from skipper flies have proved effective, reports B. B. Fulton. Fulton conducted the tests in a room constantly stocked with skippers.

Following are descriptions of devices which proved successful and which are illustrated under the corresponding letters in the accompanying diagram:

A. Ham wrapped in common wrapping paper and suspended in a sack. Two kinds of sacks were used (1) cotton feed sack which excluded the flies, and (2) open mesh orange sack which gave the flies access to the paper wrapper. Both were successful, but the first probably is safer.

B. Ham suspended by a single wire and enclosed in a large paper sack, tied tightly around the wire.

C. Ham suspended by a single wire and enclosed in a cotton feed sack, tied around the wire and hanging loosely around the ham.

D. The same as C except the wire is run through the center of a disc of corrugated cardboard which serves to hold the sack away from the meat.

E. Ham packed in and surrounded by dry hay in a large sack and suspended by twine tied around the neck of the sack. Both cotton and burlap sacks were successful.

A ham suspended in a cotton sack, as in "A" but without the paper wrapping, developed skippers. All hams kept in the room without any protection, became infested with skippers in a few days, except one heavily coated with black pepper which remained free for over two months.

When laying eggs the skipper flies seemed to show a preference for cured pork but also deposited eggs on bones, raw beef and fresh pork. When skipper eggs on meat were covered with salt and kept at ordinary room temperature they hatched, and the maggots entered the meat. When eggs were placed on salt-covered pork and kept for a month in the curing room at 38°F., they failed to hatch.

A piece of ham with skipper eggs was smoked for two days. During that time the eggs hatched and young maggots were crawling on the meat when it was removed from the smoke. In order to determine what surface temperature on a ham would be needed to kill skipper eggs, many lots of eggs were dipped in warm water for different periods and temperatures. At 130°F., the skipper eggs are killed in one minute, but at 125°F. about eight minutes are required, and at 122°F. the eggs survived 20 minutes exposure.

Type of Salt Does Not Vary Speed of Curing

Some farmers and food locker operators have reported that the speed with which salt penetrates pork loins during curing varies with the type of salt crystals used. An experiment just completed by T. N. Blumer, F. H. Smith, W. Edmunt Tyler and Alexa Williams did not bear out these reports.

The investigators selected six loins from six different hogs of similar weight and breeding. A twelve-inch section was cut from the same portion of each loin, then boned and trimmed free of fat. It was then cut into three pieces of equal length.

The three samples from each loin were randomized, then each was treated with one of the three types of salt being tested—fine flake, medium flake and granulated. Twelve grams of salt were applied evenly over the exposed surface, and the samples stored at 40 degrees F. for eight days. They were then removed and sliced into cross sections to permit study of the rate and depth of salt penetration.

Blumer and his associates found no difference in the rate of penetration nor the amount of salt absorbed. Neither were there differences in the moisture loss or amount of salt in the drip.

Hybrid Chickens Are on the Way
















Close inbreeding of chickens—brother to sister, son to mother, half-brother to half-sister, etc.—has led to the development of strains with improved growth rate and feathering at the Central and Mountain Experiment Stations.

Ten lines of poultry have been intensively inbred for three to five years under the supervision of E. W. Glazener, W. L. Blow and R. S. Dearstyne. The workers report eight promising lines developed from White Leghorns, New Hampshires, Barred Plymouth Rocks and Rhode Island Reds.

Inbreeding serves to purify strains for crossing in hybrid breeding experiments. It helps uncover weaknesses in a strain so that birds with undesirable characteristics can be culled. Inbreeding also helps to "fix" desirable factors.

High inbred Rhode Island Reds and White Leghorns have not only produced well, but show a hatchability of around 80 to 85 per cent of all eggs set in 1949. High inbreds of these two strains perform almost as well as those inbred very little, while Barred Plymouth Rocks appear less promising.

While none of the lines developed so far excel in all the desired economics traits—such as egg size, broiler qualities, production and ability to live—all have some desirable characteristics. Next year single-cross hybrids will be produced from two of the most promising inbred lines.

Degree of Inbreeding	Sexual Maturity (Days)	Egg Production (Six Months)	Mortality (Per Cent)	Body Weight at Sexual Maturity (Pounds)	Egg Weight (Oz Per Doz)
0—12.5	 188	 117	 8	 3.5	 23.6
12.5—25.0	 188	 120	 12	 3.3	 23.6
25.0—50	 192	 112	 12	 3.4	 22.8

Utility Bird is Aim of Tests at Willard

Developing a utility bird suitable for general farm conditions is the aim of poultry breeding studies at the Willard Experiment Station. The Station keeps a flock of about 700 Rhode Island Reds for study, with 25 per cent of them being selected each year for breeders.

E. W. Glazener, W. L. Blow and R. S. Dearstyne who are conducting the studies say these birds are selected for egg production, egg size and shape, hatchability and broiler qualities at 12 weeks of age. As mates, 12 to 15 males are selected for their broiler qualities and on their sisters' performances.

Just as preparations were being made for the hatching season in 1949, Newcastle struck the flock,

almost halting egg production. While birds older than one year regained normal production within about six weeks, young birds were still below normal production after 12 weeks. Some of these most affected were laying abnormally-shaped eggs a year after the disease was contracted.

Complete records were kept on the flock, and financial losses estimated on the basis of normal production during previous years. Loss to the hatcheryman was estimated to average a conservative \$3.00 per bird in net return for the three months following the outbreak.

The poultry scientists say vaccination seems to be more practical at this time than breeding Newcastle resistance into birds.

Sulfa Drug Shows Promise for Preventing, Curing Fowl Typhoid

At least one of the sulfa drugs—sulfaquinoxaline—has definite possibilities for preventing and curing severe outbreaks of fowl typhoid. B. F. Cox and F. R. Craig say their tests show this drug helps control the disease when given in drinking water in amounts recommended for the continuous method of coccidiosis treatment.

Birds treated 24 hours before disease exposure, at the time of ex-

posure and 48 hours after exposure all recovered from the disease after five days of treatment. All birds receiving no treatment died within six days.

All birds in the tests were artificially infected with measured amounts of a fowl typhoid culture. Sulfa drugs were then added to drinking water. Those receiving water treated with a soluble form of either sulfaguanidine or a com-

bination of sulfaguanidine and sulfone refused to drink. They died before those receiving no treatment.

However, treatment with the sulfaquinoxaline-sulfone combination in medicated feed apparently gave some protection against the disease. Non-lethal injections of fowl typhoid organisms brought positive reactions to the pullorum whole blood test in all cases except those treated with the combination.

Biopsy Needle Used In Poultry Studies

Development of a special instrument for removing living tissue has been a great help to F. W. Cook in his poultry blood studies.

Called the Turkel biopsy needle, the device is used widely in human surgery and has now been adapted for use on poultry. It was invented by Dr. Henry Turkel who has given Cook much assistance with the use of biopsy needles on poultry.

Combinations of needle lengths and gauges are being tried with different-sized birds. Special measures are being taken to control bleeding from the puncture—one of the most pressing problems at present.

The Turkel bone marrow needle, already widely used in human surgery, is now being used to remove bone marrow from poultry. The extremely dense bones of chickens and turkeys are hard to drill and require a needle made of especially tough tool steel.

Cook has also been able to improve his method of numerical cell counting. He has found that the clotting agent in blood—fibrinogen—helps to isolate white blood cells and thus simplify blood counts when large amounts of it are added to whole blood.

Phases of this problem still to be studied include fractionation of the cellular content of the whole blood and staining of cell types of the fluid tissue.

Vaccine Checks Newcastle at Willard



These young birds are being vaccinated for Newcastle disease.

The natural outbreak of Newcastle disease in the Willard Experiment Station flock provided an excellent opportunity to record the progress of the disease and the effects of vaccination.

B. F. Cox used killed vaccine to vaccinate four-week-old chicks hatched on the premises from eggs collected before symptoms showed up in the hens. Nearly a year after vaccination no respiratory infections had appeared in the group.

Four months after diagnosis 480 blood tests showed 32.7 per cent absolutely negative and only 2.7

per cent positive. The remainder showed too little inhibition power to be classed as positive.

Birds retained as breeders were vaccinated with one-half the recommended dose of killed vaccine. Five months later 134 blood tests for Newcastle were made. Only one of the birds was completely negative for inhibition power. The same bird had been negative following natural exposure.

Eighty-eight per cent of the breeders showed an increase in inhibition power. Ten per cent remained the same, and only three birds showed a decrease.

Bronze Turkeys Improve in Type, Egg Production, Hatchability

The Station's turkey breeding project begun in 1940 has led to important improvements in large bronze turkeys. C. H. Bostian, R. S. Dearstyne and E. W. Glazener report reduction in broodiness and length of production pauses, better hatchability, higher egg production, lower mortality and improvement in type.

In 1949 the total days lost from broodiness and production pauses of over five days was only 7.06 per cent—the lowest since the project began. During the past year, 74.1 per cent of the birds tested

showed neither broodiness nor pauses over five days.

The number of birds qualifying for Record of Performance and the average intensity of lay were both higher during the past year than before. Birds must show 50 per cent production in the first eight weeks of lay to meet R.O.P. requirements. In the Station flock, 83 per cent qualified for R.O.P., while the average intensity of lay for all birds under test was 63 per cent.

Each of the 64 birds kept for the entire laying year produced over

100 eggs. Eight laid between 150 and 160 eggs, six between 160 and 170, seven between 170 and 180, five between 180 and 190, and seven between 190 and 200. The highest producer laid 208 eggs.

The mortality rate for the first six months of life was 8.68 per cent—the lowest on Station records. Only 3.1 per cent of the hens died during the first 90 days of lay.

To check improvement in body type, shank and keel, measurements are made of body depth and breast width. These measurements were considered in selecting breeders.

PULLORUM TOPS DISEASE LISTING

A survey of 4,043 autopsies made over a 12-month period at the Poultry Disease Diagnostic Laboratory revealed the most common causes of poultry mortality. F. R. Craig reports the breakdown as listed in the accompanying table.

Diagnosis	Age Groups			Total	Per Cent of Total**
	Broilers 0-12 wks.	Range 12- 24 wks.	Adults Over 24-wks.		
Disease:					
Pullorum	161	7	22	190	16.46
Coccidiosis	167	12	2	181	15.68
Leukosis	16	36	98	150	13.00
Newcastle:	90	18	30	138	11.96
Positive*	44	11	27	82	(7.11)
Suspicious*	13	1	0	14	(1.21)
Negative*	33	6	3	42	(3.64)
Blue comb	2	29	47	78	6.76
Respiratory	32	12	19	63	5.46
Omphalitis	61	0	0	61	5.29
Typhoid	3	19	21	43	3.73
Nutritional Deficiencies	21	4	3	28	2.43
Blackhead	8	14	5	27	2.34
Streptococcus	21	3	2	26	2.25
Paratyphoid	21	0	0	21	1.82
Fowl Pox	6	3	9	18	1.56
Epidemic tremor	16	0	0	16	1.39
Stunted Chick Disease	11	0	0	11	0.95
Fowl cholera	0	2	5	7	0.61
Colibacillosis	4	0	0	4	0.35
Miscellaneous disease	30	28	34	92	7.97
Totals	670	187	297	1154	100.00
Parasites:**					
Tapeworms	7	22	28	57	42.54
Roundworms	14	14	28	56	41.79
Crop worms	1	0	6	7	5.22
Body lice	0	2	5	7	5.22
Miscellaneous	0	1	6	7	5.22
Totals	22	39	73	134	100.00

* Not included in totals.

** Diseases and parasites calculated separately.

Autopsies are often necessary to determine the cause of poultry losses.



Free-Choice Feeding Boosts Turkey Gains

Bronze turkeys during 12 weeks of confinement gain weight in direct proportion to their intake of protein up to 32 per cent, Experiment Station tests show. The free-choice method of feeding grain with a 24 to 32 per cent protein mash produced the greatest weight gains.

J. W. Kelly, R. S. Dearstyne and H. L. Lucas kept the control flock on a 24 per cent protein mash diet with corn and oats added after eight weeks. Experimental flocks were given mashes containing 20, 24, 28, 32 and 36 per cent protein, cracked corn from the first day and oats beginning the fifth week.

The birds were weighed at 14-day intervals to 12 weeks and 28-day intervals thereafter. Male poult on the control diet showed a mean weight of 5.7 pounds at 12 weeks. Male birds fed the other diets ranged from 4.4 pounds for the 20 per cent mash to 6.6 for the 32 per cent protein mash. The 36 per cent mash produced a mean weight of 6.3 pounds.

Turkeys fed 20 per cent mash needed 3.19 pounds of feed to produce a pound of meat, while those on the 36 per cent ration needed 2.95 pounds. Poults on the 36 per cent protein mash selected mash for 60 per cent of their ration. Those on 24 per cent control mash, however, selected 89 per cent of their ration from mash. The weight advantage gained by feeding the high-protein mash almost disappears after birds reach 28 weeks of age.

Feed efficiency tends to decrease as oats consumption is increased. The turkeys on the 36 per cent mash selected 38 per cent of the diet from mash, 9 per cent corn, and 53 per cent oats; thus requiring 5.3 pounds of feed per pound of meat. Whereas the birds on the 20 per cent mash produced a pound of meat on 4.8 pounds of feed which consisted of 73 per cent mash, 3 per cent corn and 24 per cent oats. The 24 per cent control mash produced a pound of turkey on 4.8 pounds of feed consisting of 62 per cent mash, 6 per cent corn, and 32 per cent oats.

Time-Motion Studies in Milk Plants

The man-minutes required to receive each can of milk varied from less than one minute to almost two and a half minutes in milk plant receiving operations studied by J. P. Nelson and W. M. Roberts. An all-day time study was made of each operation, and then specific functions common to all plants were segregated and timed in more detail.

The milk plants studied were grouped according to the volume of milk handled. Those handling from 10,000 to 20,000 pounds daily required an average of 4.290 man-minutes to receive 100 pounds of milk. Those in the 20-30M group averaged 2.449 man-minutes; 30-50, 1.920 man-minutes; and over 50M, 1.776.

The man-minutes required to receive each can of milk according to the same groupings were 2.351, 1.680, .990 and 1.162, respectively. The total time spent with each producer expressed as man-minutes was 7.390, 7.290, 2.821 and 9.908, respectively.

The functions in the receiving operation were broken down into the following elements:

1. Position can, remove lid and smell contents.
2. Position can at dump station, dump and drain.
3. Place can in can washer (if rotary can washer, remove can to conveyor).
4. Get milk thief, draw milk sample and replace sample bottle and thief.
5. Observe and record weights.

Numerous time readings were made on each element in all of the dairy plants. Average and range values of all readings for each element were as follows:

Element Number	Average Man-Minutes	Man-Minutes Range
1	.076	.053-.102
2	.06	.041-.091
3	.077	.02-.234
4	.165	.055-.393
5	.217	.061-.379

The large variation in element Nos. 3, 4 and 5 was due primarily to differences in equipment.



A stop-watch is used to time handling of milk cans on the receiving line.

Labor Utilization Studied at Dairy Plants

The production time needed for processing different dairy products varies widely from plant to plant and from day to day in the same plant.

This was shown in a labor utilization study made by A. G. Slagle, J. P. Nelson, R. B. Redfern and W. M. Roberts in six fluid milk processing plants. The plants selected for study ranged from 10,000 to 30,000 pounds in volume of milk handled and had different methods of processing. Observations extended over one full week at each plant.

The man-minutes of production time necessary for pasteurizing and cooling 100 pounds of the different dairy products varied considerably. The average values for all plants were 2.65 man-minutes for grade A, 3.69 man-minutes for homogenized vitamin D milk, 6.93 for chocolate milk, 9.07 for buttermilk, 9.54 for skim milk, and 21.31 for cream.

Bottling time per package differed considerably between plants. Bottling times ranged from .0987 minutes per quart for quarts of Grade A pasteurized milk to .7249 minutes for whipping cream.

Processing time was also checked to find ways of improving efficiency.



HTST Promising in Commercial Tests

The high-temperature-short-time (HTST) method of pasteurizing chocolate milk which has appeared promising in laboratory tests, continued to show up well in plant studies using commercial equipment.

In these tests, chocolate milk was exposed to temperatures of 161, 168 and 175 degrees F. for periods of 19 and 40 seconds in plant equipment. Each experiment was compared to two control pasteurizations of 143 degrees F. for 30 minutes and 160 degrees F. for 20 minutes conducted in the laboratory. The former exposure was used since it is the present standard recommended by the U. S. Public Health Service and Code. The latter is the exposure general-

ly used in the industry to obtain non-settling chocolate milk.

Data collected by Marvin L. Speck and analyzed by H. L. Lucas indicated that exposures at 175 degrees F. for 19 and 40 seconds and at 168 degrees F. for 40 seconds gave destruction of bacteria comparable to pasteurization at 160 degrees F. for 20 minutes.

Since this regular holder method of pasteurization (160 degrees F. for 20 minutes) gives a generous margin of safety, Speck believes that a transition to HTST pasteurization at 175 degrees F. for 19 to 40 seconds would offer no public health hazard. One main reason for preferring the HTST method is that the chocolate settled less.

Rancidity Inhibits Milk-Souring Bacteria

It may come as a surprise to many milk consumers, but milk that won't sour normally is sometimes as serious a problem as preventing souring in milk intended for fresh use. During the past two years, a number of North Carolina farmers have reported that milk from certain cows failed to sour in the preparation of buttermilk and sour cream on the farm.

Preliminary experiments indicated that rancidity developed in the milk in such cases. With this information in hand, R. N. Costilow and Marvin L. Speck undertook to determine the effect of rancidity in milk upon the growth of desir-

able milk-souring bacteria.

They found that rancidity did inhibit the growth of several of the important milk-souring bacteria including *Streptococcus lactis*. Others were not measurably affected.

The investigators demonstrated further that the inhibition could not be attributed to either the slight reduction in pH or the reduced surface tension noted in rancid milk. Rather, the inhibition was shown to be due to the intermediate fatty acids—capric, caprylic and lauric. The other fatty acids known to be in butterfat were not found to have any significant activity as inhibitors.

SLICED BERRIES GIVE BEST FLAVOR IN ICE CREAM

The amount, method of preparation and variety of fruit were shown to be important factors in preparing strawberry ice cream, in an investigation conducted by M. B. Moseley, W. S. Arbuckle and I. D. Jones.

The Massey, Missionary, Blake-more and 1039 varieties of strawberries were compared as to their desirability for use in ice cream. The Missionary and 1039 varieties produced ice cream with more color and more pronounced flavor. The ice cream containing the Mas-

sey strawberry had a mild flavor and had superior keeping qualities.

A finely sliced berry produced the most desirable flavor, body and texture characteristics in ice cream.

Pulped fruit used at the rate of 10, 15 and 20 per cent was compared to finely sliced fruit used at the rate of 10, 15, 20 and 25 per cent. The ice cream containing 20 per cent pulped fruit was approximately equal in flavor intensity to ice cream containing 20 to 25 per cent finely sliced fruit. Both were superior in flavor.

Study Nutrition Needs Of Young Dairy Calves

What are the nutritional requirements of the young dairy calf?

To answer this question, R. K. Waugh, G. H. Wise, J. S. Huff and D. W. Colvard are using purified or synthetic diets on test calves. These diets are compounded from known ingredients including carbohydrates, proteins, fats, minerals, vitamins and water mixed in the desired proportions. Their main advantage is that a single ingredient can be omitted entirely or added to the diet in varying amounts without disturbing the others.

In previous studies, calves receiving purified diets containing 3.5 per cent hydrogenated cottonseed oil developed fatty livers and low blood plasma fat. The 1949 work was aimed at determining the effect of an emulsifying agent—glycerol-mono-stearate—when added to the diet containing the hydrogenated cottonseed oil.

Fifteen calves were fed from the time they were taken from the cow to six weeks or age on three purified diets, each containing the same basal mixture. Diet A contained the basal mixture plus 3.5 per cent hydrogenated cottonseed oil and was homogenized. Diet B was the same as A except that it contained 0.5 per cent glycerol-mono-stearate in addition. Diet C was identical to Diet B except that it was not homogenized.

There was a better gain in body weight of calves on Diet A than on either B or C. The gain was poorest on Diet C.

The fat content of the livers of calves on all three diets was higher than normally found in calves fed whole milk. The blood plasma fat and blood plasma choline was significantly higher in calves fed Diet B which contained the emulsifying agent, than in calves fed Diet A which did not contain the emulsifying agent. There was very little difference in the hemoglobin content of the blood of calves fed any of the three diets. The hemoglobin content was high in all cases.

All calves on Diet C manifested an interesting peculiarity of a loss of hair around the anus and tail.

Calf Starter Permits Early Weaning



This was one of the calves used in the nutrition studies at Waynesville.

Guernsey and Jersey female calves may be weaned from whole milk at seven weeks of age, judging from a two-year study conducted at the Mountain Experiment Station by R. K. Waugh, D. W. Colvard, Howard Clapp and Ray Jarvis.

The 25 calves in this test were weaned when they were either seven, nine, or twelve weeks of age and had received 260, 361 and 537 pounds of milk, respectively. Calves on the lowest milk diet of 260 pounds received a maximum of seven pounds per day.

This amount of milk will produce satisfactory growth if the calf

is taught to eat enough of a good dry starter, the investigators found. Calves should not be weaned until they are eating a pound of starter a day.

Good alfalfa hay was fed free choice along with no more than four pounds per day of a 19 per cent protein calf starter. The dry starter was changed to a 14 per cent protein mixture after four months of age.

A commercial substitute is now being studied to determine whether or not the amount of whole milk can be reduced further.

HEIFERS THRIVE ON SILAGE WITH SUPPLEMENTS

Limited amounts of protein supplements appeared to be an adequate substitute for hay in tests with maturing dairy heifers conducted by C. D. Grinnells and J. L. Moore.

Eight purebred Ayrshire heifers were fed all the sorghum silage they would eat. Four were fed a supplement of 2 pounds of cottonseed meal per day and no hay. Four were fed a supplement of 1 pound of cottonseed meal and 5 pounds of a good quality of lespedeza hay per day. Both groups of heifers were thrifty and made a fair growth.

The groups receiving 2 pounds of cottonseed meal per animal per day made better gains in weight and in height at withers. However, both rations will grow good heifers if supplemented with an ample supply of good grazing.

WOOD MOLASSES TESTED FOR FEEDING DAIRY COWS

Palatability apparently will not be a limiting factor in the use of wood molasses as a feed for dairy cattle.

A research team headed by C. D. Grinnells has determined that cows will eat a concentrate mixture con-

Calfhood Fevers Do Not Affect Bull Fertility

Calfhood fever, either natural or artificially produced, appears to have little or no effect upon the subsequent fertility of bulls, according to the findings of a research team consisting of F. I. Elliott, C. D. Grinnells, R. K. Waugh, A. L. McLaughlin and T. C. Blalock.

The fever studies are part of an effort to determine the causes of poor fertility in bulls—a problem that grows in importance with the increased use of artificial breeding.

In one phase of this study, four bulls were given fever artificially by injections of a mixture of sulfur in olive oil. Four more bulls, carried as controls, received no treatment. The average daily temperature of the treated bulls was increased two to three degrees above normal for about three weeks.

Since it was not possible to measure the fertility of the bulls by means of breeding trials, the semen was evaluated using other criteria of fertility. No difference in the semen quality of the two groups could be noted. Also evaluated in these tests was semen from a ninth bull which had had a natural fever due to a respiratory ailment as a young calf. Again, no differences were noted.

As a further test of possible fever effects, tissue was taken by means of biopsy from the testicles of the experimental animals both before and after treatment. Examination of stained slides of tissue did not reveal any difference between the treated and untreated animals.

However, semen quality declined in all cases following the second biopsy. In fact no sperm could be found in some samples.

taining 20 per cent wood molasses. The molasses, made by hydrolyzing wood chips with sulfuric acid, are very dark in color and bitter.

The study is being continued to determine the value of wood molasses for supporting milk production.



A large swelling under the jaw (bottle jaw) is a symptom of stomach worms.

Heavy Grazing Increases Parasites

The parasite population increases so rapidly in young calves on heavily grazed pasture that the animals die where grazing persists.

Only one out of six calves tested under these conditions by C. D. Grinnells and J. L. Moore survived the experiment. The five calves that died were lost shortly after drouth periods. Drouth increases the build-up in larvae numbers, and the larvae are easily harvested by the animals as the grass begins to grow following drouth.

In these tests, parasite-free calves were placed on two groups of parasite-infested pasture paddocks. The paddocks where the animals died were grazed twice as heavily as the others. There were no deaths on the lightly grazed plots, although the parasite populations were extremely heavy at the time of slaughter.

Another phase of the parasite study was started in 1949 to determine the possible relationship between soil types and the prevalence of parasites. Several different soil types are included in this study.

Seven different soil types were infested with parasites by fertilizing them with manure from an arti-

cially infected calf. Three plots of each soil type were included.

Each plot was seeded on March 29 with Kentucky bluegrass and red top. Grass stands were not sufficiently uniform to justify larva counts. Hence, no results were obtained the first year.

Grinnells and Moore point out that the best way to reduce the number of parasites or larvae on a pasture is to graze only animals that are resistant. Mature cattle have an age immunity, while horses and mules have a species immunity.

NEW DRUG EFFECTIVE IN CONTROLLING MASTITIS

Aureomycin, one of the new antibiotic drugs, shows promise for treating mastitis in dairy cows, according to C. D. Grinnells, J. L. Moore and W. Cranor.

The investigators compared aureomycin ointment with penicillin in water solution during 1949. Each penicillin treatment contained 100,000 units, while the aureomycin treatments consisted of 200 mg. A total of 49 quarters infected with *streptococcus agalactiae* were treated—25 with aureomycin and 24 with penicillin. Three weekly tests on the treated quarters show-

Dried "Sweets" Rival Corn As Dairy Feed

Milk cows fed a concentrate mixture containing up to 48 per cent dehydrated sweet potatoes were producing as much milk at the end of three to five months as cows receiving similar amounts of corn. Purpose of these experiments conducted by C. D. Grinnells, J. L. Moore, R. K. Waugh and D. W. Colvard was to test the potatoes over a longer period of time than had been covered in previous trials.

The potatoes were fed from 90 to 148 days and in amounts ranging from 0 to 48 per cent of the concentrate mixture. Milk production was as much as when rations contained like amounts of corn.

The investigators caution that dehydrated sweet potatoes contain less protein (4.0 to 4.5 per cent) than corn. Hence, additional amounts of higher protein feeds are needed in the concentrate ration to maintain the protein level.

The potatoes fed in these tests were of unknown varieties, but they appeared to be of very good quality. Cows readily consumed the rations containing sweet potatoes, even when there were abrupt changes from one ration to another.

Dehydrated sweet potatoes have a tendency to draw moisture and should not be stored in damp places. Some caking was observed in these tests though this was not a serious problem.

ed the aureomycin to be one-third more efficient in sterilizing infected quarters than was penicillin.

Grinnells and his associates emphasize that care and management play an important part in mastitis control. Good sanitation aids in clearing up infection and controlling its spread. For instance, in one herd 20 quarters showed evidence of infection during a period of one year. Twelve of these cleared up without treatment. Seven of the remaining eight responded to treatment—five with penicillin and two with streptomycin.



FRUITS AND VEGETABLES

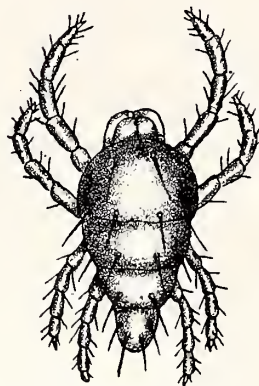
Survey Reveals Apple Insect Damage

An apple insect survey conducted in Western North Carolina in 1949 by Clyde F. Smith and George Turnipseed revealed some interesting facts concerning insect damage on certain varieties and in certain counties. It also indicated that some insects may be on the increase.

For instance, Black Twig, Wine-sap and Staymen were the varieties damaged most by the codling moth. Johnathan and Rome Beauty were damaged least. Rome Beauty was also damaged least by leaf-roller, while Red Delicious was damaged most.

The heavy apple producing counties of Wilkes, Alexander and Haywood had the highest insect damage. Over 4 per cent of the apples surveyed in Wilkes and Alexander had been stung by codling moth. Haywood had over 5 per cent leaf-roller damage.

There was a widespread and rapid build-up of European red mites during late June and early July, 1949. Infestation was so severe in many orchards that it caused a bronzing of the leaves. The infestation started to decline the latter part of July due to natural control, thus making it difficult to evaluate the different

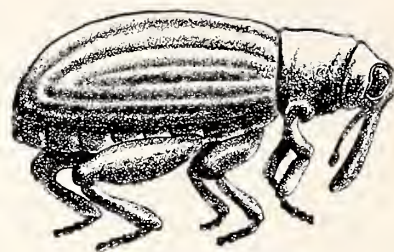


European Red Mite

miticides tested.

A severe outbreak of the apple flea weevil was found in an orchard near Asheville. An experiment was set up using the following insecticides at the rates indicated per 100 gallons of water: one pound of 15 per cent parathion, one-half pound of 15 per cent parathion, 3½ pounds of Kryocide, one pound of benzene hexachloride (25% gamma), four pounds of 25 per cent toxaphene, two pounds of 50 per cent Aldrin, and two pounds of 15 per cent dieldrin.

All of these materials gave better than 99 per cent control of the adult weevils. Normally, the apple flea weevil is of minor importance



Apple Flea Weevil



17-Year Cicada

as a pest of apples. However, Smith and Turnipseed believe the pest could become very abundant and cause considerable damage to the foliage.

The 17-year Cicada—an insect that attacks young apple trees—was observed in Caldwell, Burke and Henderson Counties in 1949. One orchard in Henderson County was practically destroyed by the pest. The adult females cause damage by depositing eggs in the small trees, thus weakening them and causing some to break over and die.

Summer Sprays of DDT, Parathion Control Peach Tree Borers

Peach Tree Borer

DDT and parathion, used separately or in combination as summer sprays, gave fair control of the peach tree borer in experiments conducted in two different orchards by Clyde F. Smith and Clarence Black.

The trees were sprayed July 9 and August 10, and checked for borers on August 25. The summer sprays were not as effective as ethylene or propylene dichloride emulsion used after all of the moths are through laying eggs. However, the use of summer sprays is recommended because most of the borers are killed before they have time to do much damage to the trees.

Plum Curculio

Parathion is also one of the most promising materials yet used for the control of plum curculio. By using parathion in the variety block at the Sandhills Peach Station, Smith and Black produced fruit that was almost 100 per cent worm-free. Other materials used on this same block in previous years gave control ranging from 0 to 24 per cent in 1948, 0 to 32 per cent in 1947, and 0 to 52 per cent in 1946.

Results were equally promising where parathion was used in commercial orchards under the supervision of Smith and Black. One main disadvantage with using parathion is that it is very poison-

ous to human beings and must be used with extreme caution.

Chlordane was also tested for curculio control but the results were not satisfactory. This is the second year of unsatisfactory results in North Carolina, though research workers in the Midwest have obtained good results with chlordane.

Scale Insects

Use of parathion for plum curculio control also gave good control of the San Jose scale. Rates of application in these experiments were one and two pounds of 15 per cent wettable powder per 100 gallons of spray. The two-pound rate gave fair control of the white peach
(Continued on Next Page)

Two Types of Spores Can Spread Black Rot

A detailed cytological study by C. N. Clayton of the fungus that causes black rot and leaf spot of apples has yielded evidence that both types of spores produced by the organism can cause the disease.

Physalospora obtusa is the name of the fungus which lives in dead bark of many kinds of plants. It produces two kinds of spores—ascospores and conidia, but only conidia has been considered of much importance in causing infection on apple leaves and fruits.

Clayton now believes that both types may be important in causing leaf spot. As a result he is studying the life history of the fungus, particularly the ascospore stage.

Spraying for Insects Affects Peach Flavor

Taste tests of peaches sprayed with different pesticides, showed that there were measurable differences in flavor as a result of spraying. However, Clyde F. Smith, Ivan D. Jones and Lyle Calvin report that the differences were so small that they would not influence consumer purchases of peaches.

The peaches were sprayed five times during the season with different combinations of spray materials which included parathion, chlordane, acid lead arsenate, benzene hexachloride (two applications only), sulfur and phygon. Unsprayed trees were left as a check.

Both fresh and canned peaches were used in the taste tests.

SUMMER SPRAYS

(Continued from Preceding Page) scale as well, but where the one-pound rate was used, the white peach scale was nearly as abundant as on the check plots.

Oriental Fruit Moth

Experiments were planned to find improved control measures for the Oriental fruit moth, but the moth population was extremely low throughout the Sandhills area in 1949. There was an average of only 2 per cent infested fruit at harvest.

Peaches Benefit From Soil Treatment

Attempts to reset peach trees on old peach orchard sites in the Sandhill area have almost always resulted in failure. The trees usually survive for only a few years.

Although several factors undoubtedly are involved, it is known that the root-knot nematodes are numerous in many old peach orchard soils. In such cases, young peach trees frequently are attacked by the nematode disease and die or are severely stunted in the first or second season after planting. On older trees the root-knot disease causes stunting and reduces yield.

C. N. Clayton began experiments in 1945 to determine the effects of treating old peach orchard soil with chemical fumigants, manure or cultural practices before setting the trees. Although it is still too early to know how long the trees will live, Clayton has found that soil fumigants increase the growth of the trees and yield of peaches.

The fumigants or manure were applied to the tree sites (8 x 8 feet) in November, 1945, and Golden Jubilee peach trees were set in February, 1946. The following treatments were used: a) chloropicrin at the rate of 0.13 pound per square yard injected about six inches deep on 10-inch centers; b)

dichloropropane-dichloropene mixture (Shell D-D) at 0.08 pound per square yard injected in the same manner as with chloropicrin; c) urea (Uramon) broadcast at the rate of one pound per square yard and then disked into the soil; d) stable manure broadcast at the rate of four pounds per square yard and disked; and e) untreated.

The surface of the soil after injection of the chloropicrin or D-D was kept wet for three days. The manure treatment was repeated in the late fall of 1946.

At the end of the first growing season, root-knot control was very good where the soil had been treated with Uramon, D-D and chloropicrin. The manure treatment did not appreciably affect the severity of root-knot. By the end of the second year, root-knot on peach roots was $\frac{1}{3}$ to $\frac{1}{6}$ as severe in chloropicrin, D-D or Uramon plots as on the untreated plots.

The trees on all treated plots were much larger than those on untreated plots. Manure had increased growth, but some trees severely stunted.

All treatments greatly increased the yield of peaches in comparison to the untreated plots. The highest yield was from the chloropicrin-treated plots.

A severe case of root knot on the roots of a young peach tree.



"Tagged" Phosphate Used on Grapes

Radioactive phosphate placed in auger holes in the soil of a vineyard of James muscadine grapes was found a few weeks later in the leaves of vines as much as 30 feet away from the holes. The finding leads W. L. Lott, D. P. Satchell and N. S. Hall to conclude

that the active feeding roots of grapevines must pass under a neighboring vine and extend as far as 12 feet on the other side.

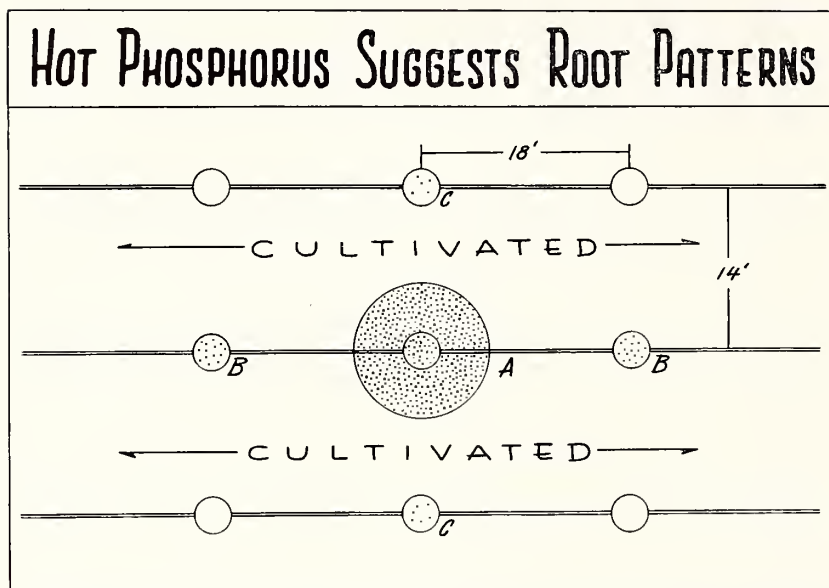
In other experiments, the team of investigators broadcast radioactive phosphate on the soil surface for a radius of six feet around

single vines. A month later, leaves from neighboring vines as well as those fertilized were tested for radioactive phosphate.

Vines adjacent to the fertilized vine and in the same trellis row (see drawing) showed pronounced uptake of radioactive phosphorus. Their concentrations averaged 13.5 per cent as much as those found in the fertilized vines and ranged as high as 80 per cent. Only small concentrations were found in vines located across the middles from fertilized vines. Vines located more than 18 feet away in any direction failed to show any radioactive phosphorus.

Muscadine vines are trained on a two-wire vertical trellis, and the soil of the middles is disced occasionally to keep down weeds. Evidently, the discing keeps feeding roots from growing across the middles, so that the roots extend mostly through the soil under the trellises.

From these results it appears that fertilizer will be more effectively used when distributed in a band about three feet wide under the trellis than when broadcast over the whole land area of the vineyard.



Horizontal lines in the above chart represent trellis rows—the circles are individual vines. Radioactive phosphorus broadcast in the shaded area surrounding Vine A was found in pronounced quantities a month later in adjacent Vines B. Smaller quantities found in Vines C suggest that cultivating between the trellis rows may sever some of the roots.

New Grapes Solve Weather Problem

Adverse weather during bloom in 1949 brought out one of the main advantages of the new perfect-flowered varieties of muscadine grapes.

C. F. Williams, V. H. Underwood and G. M. Darrow report that 12 perfect-flowered varieties, furnishing their own pollen, produced yields that were double those of the previous year. In contrast, 27 pistillate varieties, depending upon nearby "male" or perfect-flowered vines as sources of pollen, yielded less than half as much as in the previous year. This would seem to indicate that the weather interfered with their pollination.

Williams and his co-workers are

attempting to breed perfect-flowered muscadines with yield and quality to compare with such old pistillate varieties as Scuppernong, Hunt and Thomas. Since the introduction of the first perfect-flowered varieties in 1945 they have been used as pollinators in vineyards in place of "male" vines which produce no fruit. Perfect-flowered varieties recommended at present are Burgaw for the dark muscadines and Wallace for the white.

Over 7,000 seedlings of the new breeding cycle are now under test. Most of these should fruit for the first time in 1950.

New Raspberry Equals Latham in Quality

A red raspberry selection developed by C. F. Williams and known as 40-7-6 has been released to propagators for increase and introduction. It is a second generation hybrid resulting from a cross between the Asiatic trailing raspberry, *Rubus parvifolius*, and American varieties.

The fruit resembles Latham in size and shape and is as good or better in quality. The plant is vigorous, productive and resistant to disease. It holds its foliage well throughout the summer and is especially adapted to eastern North Carolina. Yields in row tests have averaged between five and six pints per plant.

PARATHION, TEPP CONTROL STRAWBERRY MITES

Two new insecticides—parathion and TEPP (tetra ethyl pyrophosphate)—have proved effective for controlling strawberry spider mites, according to B. B. Fulton. Local or general outbreaks of the pest have occurred in the State's main strawberry-growing region every spring since 1946. The mites were especially damaging in 1949.

Parathion 1 per cent dust was found effective both at high and low temperatures. However, Fulton recommends it only for winter use because of the poisonous residue it may leave if used within a month of picking time. The entomologist found TEPP .66 per cent dust to be very effective and recom-

mends it as well as sulphur dust for use to within a few days of picking time.

Fulton reports two possible advantages of parathion over dinitro dust for winter use. It has not caused any foliage burn, and since it is a general insecticide with many uses, it is more available than dinitro. However, the dinitro dust causes little or no burn in cold weather and is still considered more effective for winter use be-

cause it kills many of the eggs as well as the mites.

The use of a power duster greatly improves the effectiveness of winter dusting, Fulton reports. The increased force of the dust blast gives better coverage of the underside of the leaves.

Spider mites were found to be present in some strawberry fields in considerable numbers in October, although no injury to the plants were noticeable at that time.

Breeding May Revive N C Dewberry Industry

New selections of dewberries now under test brighten the prospect for a revival of North Carolina's once prosperous dewberry industry, report C. F. Williams and V. H. Underwood.

At one time North Carolina grew about 1200 acres of commercial dewberries for the fresh fruit market. Because of competition from other fruits and decreased yields as a result of diseases, only about one-tenth of this acreage is now in production. Yields have dropped from 150 crates to only 50 crates per acre.

One of the new selections developed by Williams and Underwood was released in 1949 to co-operating growers for field testing and plant increase. Known as 38-7-3, this selection came from a cross between Austin Thornless and Lucretia. Lucretia is the variety now in most widespread use.

Although one of the parents is thornless, 38-7-3 has thorns. It is more vigorous and disease-resistant than Lucretia, and the foliage stays green and healthy through harvest. The fruit is as large as that of Lucretia, is somewhat firmer and ripens a few days earlier.

Station Introduces New Blueberries

Two new blueberry varieties, the Murphy and Wolcott, are being introduced as early, vigorous, canker-resistant varieties worthy of comparison with Weymouth, June and Stanley, report E. B. Morrow and G. M. Darrow. The increased vigor and canker resistance come from Crabbe 4, a high-bush swamp type from eastern North Carolina which was used as one of the grandparents.

The season of ripening for Wolcott is about the same as for Weymouth. The season for Murphy is slightly earlier than for June and Stanley. The berry size of each variety is about the same as Weymouth but larger than June and

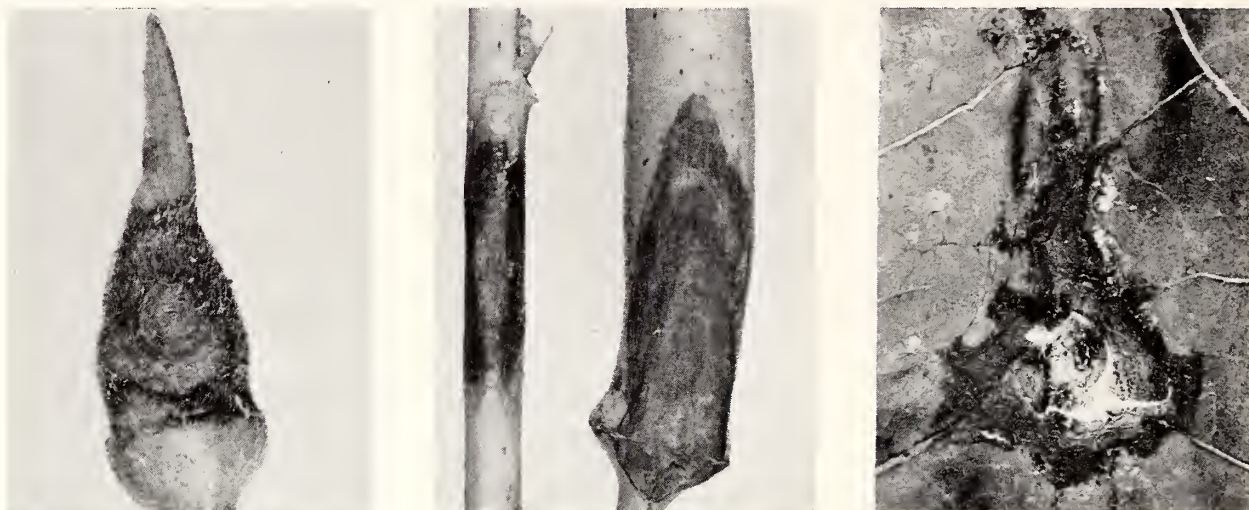
Stanley. The average number of berries per half-pint cup for three seasons, 1946-1948, was 113 for Wolcott, 109 for Murphy, 108 for Weymouth, 161 for June, and 136 for Stanley. The two new varieties are fully as productive as Weymouth.

The cross from which these varieties were selected was made by the late Frederick V. Coville of the United States Department of Agriculture. The plants were selected in 1940 by H. H. Moon and E. B. Morrow from 900 seedlings growing on the farm of Harold G. Huntington of Atkinson, N. C. The Wolcott has been tested as NC 255 and the Murphy as NC 262.

This red raspberry selection has performed well in eastern North Carolina.



Blight Attacks Okra in Mountains



Ascochyta blight of okra may be recognized by the spot (center) and lesions on the leaf (right). The block dots on the flower bud (left), lesions on the stem and pod are spore-bearing bodies of the ascochyta blight fungus.

One reason farmers and home gardeners in the mountain area of North Carolina often have difficulty growing okra is because of a fungus disease known as Ascochyta blight.

Okra plantings in Henderson County in 1948 and 1949 were severely attacked by this virulent parasite. The disease was most

severe in late August and September during cool, wet weather when it reduced production to practically nothing.

D. E. Ellis and C. E. Lewis report that the disease causes losses in two ways—first by its effects on flowers and pods, and second by weakening the entire plant through attacks on stems and leaves (see

accompanying photo).

An experiment conducted at the Mountain Vegetable and Fruit Station in 1949 indicated that spraying with Ferbam may offer a possible means of combating the disease. Ferbam-sprayed plants gave the highest yields and the lowest disease ratings of the many fungicides tested.

Pelleted Seed Improves Lettuce Stand, Requires Less Thinning

Lettuce is one North Carolina truck crop which can be grown very successfully from pelleted seed, reports J. M. Jenkins, Jr. Uniform spacing of plants, reduced thinning costs, elimination of plant growing and transplanting costs and an earlier and more uniform crop are the principal advantages of using pelleted lettuce seed.

After making small plot tests in 1948, Jenkins used pelleted seed to plant an acre of lettuce in 1949. A precision planter was used to place single pellets at intervals of two inches.

At the same time, a comparable planting was made using non-pelleted seed. With the rows 36 inches apart, it required about 11 pounds of pelleted seed, or the equivalent of about three ounces of non-pel-

leted seed per acre. The non-pelleted seed was planted at the rate of two pounds per acre.

In this semi-commercial test, the plants came up to a near-perfect stand and grew off more rapidly than those that had been grown from non-pelleted seed. The reason for this seemed to be that the plants from pelleted seed were not crowded and had plenty of room to develop, whereas the other plants were bunched together.

The plants from pelleted seed were thinned about a week sooner, requiring only about half as long for thinning. Furthermore, the plants from pelleted seed produced a more uniform crop and were harvested a week earlier than the other planting. Commercial growers who saw the test were inter-

ested to the extent that several hundred pounds of coated lettuce seed were planted in North Carolina, with very good stands resulting.

Pelleted and non-pelleted seed of spinach, carrot, radish, cabbage and tomato were also compared in 1949. Jenkins found that plants from pelleted seed emerged from one to two days later than plants from non-pelleted seed. But in all cases, thinning costs were reduced. In the case of carrots and radishes, the pelleted seed resulted in higher yields of well-shaped roots.

Jenkins concludes that the cost of producing certain vegetables such as lettuce and some root crops may be reduced and more uniform crops grown from pelleted seed where this method can be used.

DRENCHES CONTROL LETTUCE MILDEW

Drench applications of Dithane Z-78, Fermate and Tersan gave good control of lettuce mildew in experiments conducted by Frank A. Haasis and D. E. Ellis. The disease had caused some serious losses of plants during previous seasons.

Before the lettuce was seeded, the plant bed sites were treated with soil fumigants to control lettuce damping-off. The first drench treatments with the fungicides were applied on November 28 at the time of seeding. They were continued at weekly intervals until January 9, making a total of seven applications.

A preliminary estimate of the amount of mildew infection appearing in each treatment was made on January 17. Then on January 27, plants were taken at random from each plot and examined.

Here is one example of the results: of the Iceberg lettuce plots treated with Fermate drench, only six of 150 plants examined showed mildew. Ninety of the 150 plants examined from the control plot were infected.

No infected plants were found in either the Iceberg or Romaine type lettuce plots where Dithane Z-78 drench was used.

BORON DEFICIENCY FOUND ON BROCCOLI IN STATE

Boron deficiency symptoms have been observed on broccoli at all locations where this crop has been tested in North Carolina, reports F. D. Cochran.

The most common symptom in young plants, says Cochran, is irregularly shaped leaves which, in some cases, are quite twisted and curled. The foliage may also appear to be chlorotic and mottled. At harvest time the deficiency shows up in the form of hollow stems just below the head. In the more severe cases, the interiors may be discolored, although neither condition greatly affects marketability.

A more pronounced symptom was found in fall-grown broccoli crops at Hendersonville. In addition to the hollow stems, numerous external lesions appeared on the stems just below the heads as shown in the accompanying photograph. In some cases, this was severe enough to render the crop useless.

In a 1949 experiment at the Mills River Vegetable Station, an application of 20 pounds of borax per acre added to the fertilizer gave excellent results. The external symptoms were corrected, and the quality of the crop was excellent. In untreated plots, the deficiency was so extreme that the crop could not be marketed.

The experiments are being continued at Hendersonville and at the Faison Vegetable Research Farm.

SPRAY OFTEN TO CHECK ANTHRACNOSE

Frequent spraying is necessary for good control of stem anthracnose disease in lima beans, judging from the results of tests at the McCullers Station.

The reason, say D. E. Ellis and U. L. Diener, is that the fungicides which are most effective remain active only a few days. Another reason for frequent spray is to protect the new growth against infection.

Dithane Z-78, Parzate and Phygon were used in the 1949 tests at McCullers. Each material was applied at 5-, 10-, or 15-day intervals to determine which schedule gave best control.

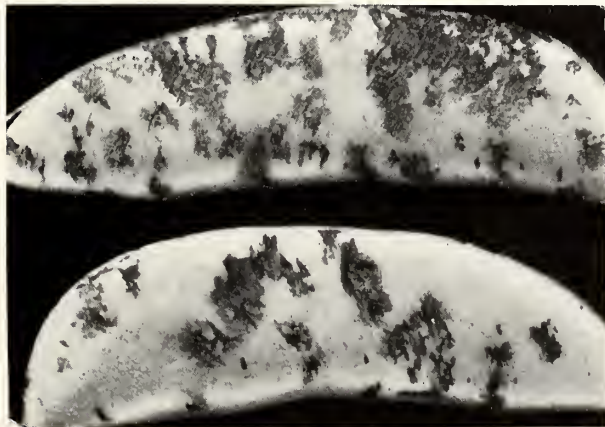
Dithane Z-78 and Parzate applied at 5-day intervals resulted in the highest yields—350 and 390

bushels of marketable fruit per acre, respectively. Applications at 10-day intervals reduced the yields by almost one-half, and at 15-day intervals by two-thirds.

On the basis of this and previous tests, Ellis and Diener recommend that lima beans be sprayed every five to seven days with Zineb (Dithane Z-78 or Parzate). These materials should be used at the rate of 1.5 pounds per 100 gallons of water. The first application should be made when the disease is first noticed or when plants are starting to blossom.

Stem anthracnose may be recognized by the brick red blotches it causes on the lima bean pods. It causes serious losses in commercial and home garden plantings.

Pod lesions (left) and leafspots and vein discolorations (right) are the symptoms of stem anthracnose of lima beans.





The symptoms of tomato late blight are wilted leaves and rotted fruit.

Copper Dust Controls Severe Blight

Late blight of tomato was so severe in Western North Carolina in 1949 that practically no edible tomatoes (see photo) were produced, either in commercial plantings or home gardens, without the use of protective fungicides. Under these extreme conditions, D. E. Ellis confirmed previous findings that tribasic copper sulfate dust does the best job of controlling late blight of the various fungicides tested.

Ellis made a total of 17 applications of each fungicide, using an average rate of 30 pounds per acre per application. The first application was made as soon as the plants

were growing off well after transplanting. The plants were dusted once each week and more frequently when the dusts were washed off by rains.

The tribasic dust containing 7 per cent metallic copper gave the highest average yields and lowest percentage of rotted fruit. Ellis cites these results as further evidence that it is possible to control late blight in western North Carolina even under weather conditions extremely favorable to disease development.

Details are given in Extension Circular 331.

SOUTHLAND, PAN-AMERICAN TOMATOES RESIST WILT

Southland and Pan-America, two comparatively new wilt-resistant varieties of tomatoes, produced yields three and four times greater than such standard varieties as Marglobe, Rutgers and Pritchard in 1949 tests at the McCullers Station.

D. E. Ellis and U. L. Diener say the superior wilt-resistance of Southland and Pan-America accounts for the differences. The soils at the McCullers location, like many throughout North Carolina, are

heavily infested with *Fusarium* wilt.

In the McCullers tests, a high percentage of plants of the older varieties showed wilt symptoms by mid-July. Few if any of the Pan-America or Southland plants showed *Fusarium* symptoms, although a few were affected by bacterial wilt, a separate disease.

Yields in tons per acre of marketable tomatoes averaged 13.4 for Southland; 12.9 for Pan-America; 5.2 for Pritchard; 4.2 for Rutgers and 2.1 for Marglobe.

Kill Vines To Prevent Spread of Late Blight From Vines to Tubers

The spread of potato late blight from vines to tubers during harvest can be prevented by spraying or dusting the vines with a weed killer or defoliant about seven days before digging begins, says L. W. Nielsen.

Late blight has been a serious problem for Irish potato growers of eastern North Carolina during the past few years. In fields where the vines are badly diseased, the spores are shaken from the vines during digging and thus contaminate the tubers.

The spores then germinate on the cool, damp potatoes and cause a decay which is first noticed some five to seven days later. Most growers are unaware of the damage since late blight tuber rot usually develops while the potatoes are on the way to market or after arriving.

Nielsen tried two of the most popular defoliants (Aero defoliant dust and Sinox General spray) during 1949. When applied well ahead of digging, these chemicals destroy the vines and the disease as well, since the late blight fungus does not live on dead plant tissue.

Another method of killing the vines which proved successful in 1949 tests was the use of the Roto-beater. This machine mutilates the vines and spreads them out where they dry rapidly. Tuber rot was controlled successfully in this manner when the vines were mutilated two or more days before harvest.

Nielsen also found that washing and drying contaminated potatoes greatly reduced the number of potatoes that later became diseased. Spores lodged in cracks, bruises or deep eyes and not removed by the washer or destroyed by the heat of the drier later caused decay. Washing alone was less effective than washing plus drying.

Several new potato varieties developed in recent years have resistance to late blight. Of these, Essex and Chenango have been found to produce as high or higher yields than Irish Cobbler. However, the supply of seed is still limited.

New Varieties Resist Late Blight

The planting of late blight-resistant potatoes in eastern North Carolina would save growers an estimated \$200,000 annually in dusts, sprays and extra labor, say F. D. Cochran and D. T. Pope.

With this goal in view, the two investigators are continuing their testing of such new resistant varieties as Chenango, Essex, Ashworth and Kennebec to determine their adaptation to North Carolina conditions.

The comparative yields of these varieties for 1949 at two locations are shown in the following table: All of these varieties produce smoother tubers and exceed the Irish Cobbler variety in market appeal.

Two other varieties that are not

resistant to late blight have also performed well, Cochran and Pope report. They are White Cloud, an early white variety, and LaSalle, a medium season white. Both yield well and make a very desirable appearing potato for the market.

COMPARATIVE YIELDS OF IRISH POTATO VARIETIES

Variety	Yield In Bushels Per Acre (US #1's)	
	Camden	Jefferson
	N. C.	N. C.
Chenango	487	370
Essex	573	451
Kennebec	374	461
Ashworth	563	—
Irish Cobbler	234	320
LaSalle	394	288
White Cloud	355	242

Growers Must Improve Appearance of Potatoes

All states producing Irish potatoes in competition with North Carolina either wash or wash and dry their product before placing it on the market.

To help North Carolina growers meet this competition, F. D. Cochran and D. T. Pope intensified their studies of improved handling and grading methods during 1949.

In general, they found that wash-

ing and washing plus drying improves the appearance of the product. But they also found that washing reduces the keeping quality of potatoes. Thus, when hot weather (above 70 degrees) prevails, Cochran and Pope advise precooling or refrigeration during shipment to market. Precooling is especially important where potatoes are washed and bagged wet.

FERTILIZERS SUPPLY MOST PHOSPHORUS IN POTATOES

Up to 89 per cent of the phosphorus in Irish potato plants at the ten-inch height may be derived from the fertilizer, according to tests conducted by C. D. Welch, N. S. Hall and W. L. Nelson. The investigators interpret this finding as one more reason why potatoes require such high amounts of fertilizer for good yields.

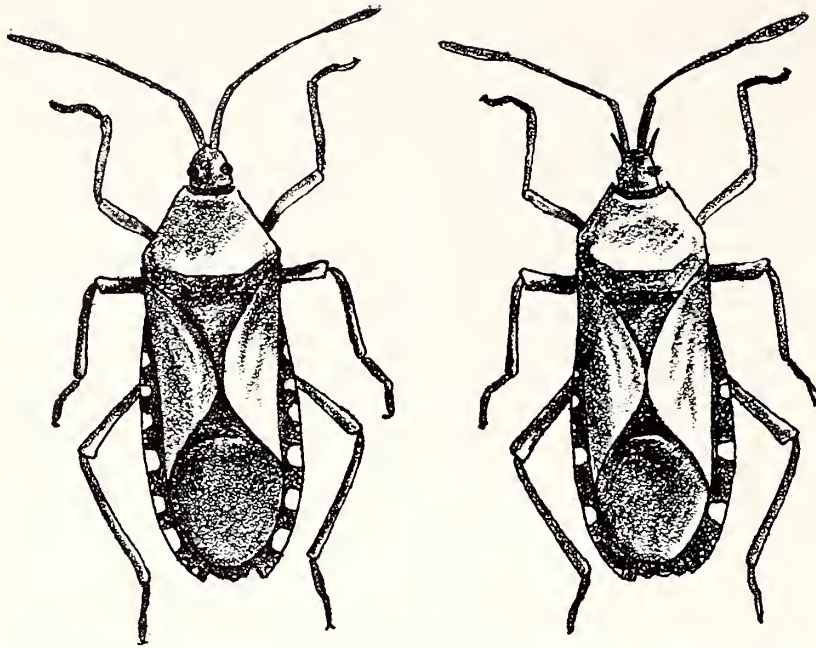
The tests were conducted on a Bladen silt loam containing 230 pounds of available P_2O_5 per acre. The equivalent of 200 pounds of P_2O_5 per acre was supplied in an application of one ton of 5-10-5.

Even though the yield of potatoes in this test was 210 bags per acre, only 12 of the 200 pounds of P_2O_5 applied was removed by the potato tubers themselves. The remainder of the fertilizer phosphorus remained in the soil.

From the results, it is easy to see why fields test high in phosphorus after producing several crops of potatoes. The potatoes continue to respond to rather high rates of phosphorus concentrated near the plants. Other crops, however, such as corn or soybeans give little response to phosphorus applied under these conditions because the roots of these crops reach and can use phosphorus further out in the soil.

The potatoes on the left were washed and dried—those on the right unwashed. Note the difference in eye-appeal.





The horned squash bug (right) was the insect found most often on cucurbit crops. The squash bug (left) was rarely found in this Eastern Carolina survey.

Station Surveys Fall Insects

On the theory that insects may be helping to spread the internal cork disease, P. O. Ritcher made a survey of insects occurring in sweet potato fields of eastern North Carolina during the fall of 1949.

Leaf hoppers of several kinds and sweet potato flea beetles were the most abundant insects found. They were found in large numbers in most of the fields surveyed. Aphids, which have been suspected of transmitting internal cork, were found in only a few plantings.

The horned squash bug, *Anasa armigera* Say, was the most abundant of squash bug species found on cucurbit crops in North Carolina by P. O. Ritcher.

Ritcher reports that he rarely encountered *Anasa tristis* De G., the squash bug of major importance in the North. Small numbers of the southern leaf-footed plant bug were found on summer squash and cucumbers.

Unlike *Anasa tristis*, which prefers squash and pumpkins, the horned squash bug was found most often on fall cucumbers. Both species were parasitized by the tachinid fly. The highest percentage of parasitism found was at the McCullers Station on August 19, when

44.4 per cent were parasitized.

The turnip aphid and the vegetable weevil—two insects that were unusually destructive to turnips during the mild winter of 1949-50 — were effectively controlled with insecticides, in tests conducted by P. O. Ritcher.

In a series of small scale field plots at the McCullers Station, Ritcher tried out 1 per cent rotenone, 3 per cent nicotine and 1½ per cent lindane dusts with the temperature at 78 degrees. Under these conditions, the lindane and nicotine (with lime as a diluent) each gave excellent control of aphids. The rotenone dust was only slightly less effective. However, the nicotine dust gave no control of flea beetles, while the other materials gave excellent control.

In a second series of tests conducted later when temperatures ranged from 60 to 64 degrees, only lindane gave excellent control. CS 674 A (a nitroparaffin) and 2 per cent CS 674 A were included in these tests.

Later observations of turnip plots treated for aphid control revealed heavy infestations of vegetable weevil larvae on certain plots.

No BHC Flavor Found In Yams After Cotton

Benzene hexachloride, used to control boll weevils on cotton, was not found to affect the taste or odor of sweet potatoes grown on the same land following cotton.

D. T. Pope, F. D. Cochran and I. D. Jones undertook this experiment because benzene hexachloride had been found to produce undesirable flavors and odors when applied directly to a fruit or truck crop. It was thought that enough of the material might remain in the soil after a cotton crop to produce a similar effect on sweet potatoes.

The tests were conducted in the Panther Creek Township of Wake County. The land had been in cotton in 1948 and treated with benzene hexachloride. Porto Rica variety sweet potatoes were planted on May 25, June 6 and June 16. All lots were harvested on October 10.

The roots were sampled on the date of harvest, at the end of the curing period and during storage. In cooking tests conducted in the Food Processing Laboratory at State College, the samples were both baked and boiled. In other tests, slices were taken from several individual roots and were boiled and mashed together to make a composite sample.

Benzene hexachloride was not detected in any of the taste tests, and no undesirable flavors or odors were noted.

WILMINGTON LABORATORY INSTALLS STORAGE ROOMS

Installation of two 12' x 12' cold storage rooms to be used in bulb and vegetable storage experiments highlighted 1949 progress in improving facilities at the Vegetable Research Laboratory near Wilmington.

Temperatures in the rooms can be held at any point between 34 and 60 degrees F. The rooms will also be used for seed storage, for testing the keeping qualities of different varieties of cut flowers and for studies of certain bulb diseases which are affected by storage temperatures.

Vitamins Vary Little With Planting Dates

Dates of planting and harvest were found to have little effect on the vitamin content of sweet potatoes, in tests conducted by Harriet P. Tucker, F. D. Cochran, Walter J. Peterson and M. E. Gardner.

In these tests for affect on carotene (pro-vitamin A) and ascorbic acid (vitamin C) content, two dates of planting and three dates of harvest were tried. The planting dates were (1) the earliest frost-free date, and (2) three to four weeks later. The harvest dates were (1) seven to eight weeks before the usual killing frost, (2) three weeks before the usual killing frost, and (3) the latest possible date before killing frost.

The varieties tested were Porto Rico and Oklahoma-24, a promising new variety. Although the differences in ascorbic acid content of these two varieties were not large, Oklahoma-24 was consistently higher.

Oklahoma-24 consistently contained about three times as much carotene as Porto Rico. Potatoes of the newer variety were a uniform orange throughout, while the Porto Rico potatoes were streaked with orange.

Differences between dates of planting and harvest were not large, although the second harvest gave slightly higher values for both vitamins than did the first harvest.

Shallot Shows Promise as New Truck Crop

The shallot, a type of multiplying onion which, at present, is grown largely in Louisiana, offers possibilities as a new crop for vegetable growers in North Carolina.

A smaller Louisiana crop due to disease, along with the fact that North Carolina is relatively close to the large northern markets make shallots a possibility as a new crop for North Carolina. A survey of soil and weather conditions indicated that the crop could be grown successfully in the southeastern part of the State.

During the past three years, J.

Shading Alters Vitamin Content of Greens

Growing turnip greens under irrigation and shading them with cheesecloth caused several interesting changes in their vitamin content, according to Walter J. Peterson. Peterson heads a research team investigating the effect of soil and weather on the nutritive value of vegetables.

Shading in both the irrigated and non-irrigated plots increased the carotene (pro-vitamin A) content, while irrigation alone decreased the content of this vitamin. In the irrigated areas the vitamin values for shade and no shade were 59 and 44, respectively. In the non-irrigated areas, the values were 61

and 46 milligrams per 100 grams on the dry weight basis.

The riboflavin (vitamin B₂) was also increased by shading and decreased by irrigation, although the increase due to shading was not as large as for carotene. The ascorbic acid (vitamin C) content on a dry weight basis did not appear to be affected appreciably by either shading or irrigation.

As would be expected, both shading and irrigation increased the moisture content. Before final conclusions can be drawn, however, the experiment will have to be repeated over several years to allow for variations in weather.

SOIL FUMIGANTS CONTROL NEMATODES

In their continuing study of nematode diseases on vegetable crops, D. E. Ellis and R. G. Owens have found that soil fumigants are not equally effective in controlling different species of nematodes and on different crops.

For instance, greenhouse and field experiments in 1949 showed that chloropicrin and dichloropane-dichloropropene mixture are somewhat more effective against meadow nematodes than is ethylene-dibromide. Yet in 1948 tests for control of another soil pest—the root knot nematode—ethylene-dibromide appeared best adapted.

Ellis and Owens tested the three materials in 1949 at rates equivalent to 200, 400 and 600 pounds per

acre. Sweet corn plants were grown for 90 days in treated soil, and the relative numbers of meadow nematodes present in the roots were then determined.

The results of a representative test, given in the accompanying table, show that at 200 pounds per acre, all three materials markedly reduced the nematode population. At 400 and 600 pounds per acre, however, the populations were reduced to a much lower level by chloropicrin and dichloropane-dichloropropene mixture than by ethylene dibromide.

Meadow nematodes are present in most North Carolina soils.

Effect of soil fumigants on the number meadow nematodes in Golden Bantam sweet corn roots after 90 days.

	Material Rate per acre	Av. No. of nemas per 5 gm. root sample
Chloropicrin	200	30.5
	400	1.3
	600	0
Ethylene dibro- mide (10 per cent by volume)	200	44.5
	400	36.3
	600	34.5
Dichlorophopane- dichloropropene mixture	200	33.5
	400	1.3
	600	0
Check		92.8

Poor Coverage Permits Build-up of Beetles

Failure to apply the insecticide to the under surfaces of the leaves was diagnosed by P. O. Ritcher as one of the main reasons for failure to control the Mexican bean beetle in the mountain area during 1949. Other factors, says Ritcher, were (1) excessive rainfall which washed off the insecticide and (2) applying the dusts at a time of day when humidity was high and temperature low—conditions that reduce the effectiveness of rotenone.

The bean beetle was unusually destructive during 1949, especially in the Mills River area of Henderson County where some 7,000 acres of snap beans were grown. In spite of repeated applications of insecticides, many early patches were so heavily damaged that by picking time the plantings had to be abandoned or plowed under. Fall plantings were also infested.

To find out if the failure might be due to the insecticides used, Ritcher tried five different dusts: .75 per cent rotenone, a mixture containing rotenone, pyrethrins and piperonyl cyclonene, 5 per cent methoxychlor, 2 per cent parathion and 2 per cent CS 645A (a nitro-paraffin).

Counts of the larvae made in late September showed that all the materials used gave good control.

TEST PERMITS DETECTION OF SPOILAGE IN PICKLES

A new chemical test which permits the early detection of spoilage in brine-stored cucumbers has been developed by T. A. Bell and J. L. Etchells and I. D. Jones. Bell and Etchells are resident cooperators of the Bureau of Agricultural and Industrial Chemistry of the U. S. Department of Agriculture.

The test promises to be of great value to the nation's pickle packers by reducing brine-storage losses. It is used for detecting a pectin-splitting enzyme associated with the softening of brined cucumbers. Such spoilage is an old problem with the homemaker and commercial packer alike.

Bell, Etchells and Jones expect the test to become routine.

Treat Bulbs to Control Leaf Scorch

Stagonospora leaf scorch disease of Narcissus can be eradicated or materially diminished by treating infected bulbs with hot 0.5 per cent formalin at the time the bulbs are dug in the summer, reports Frank A. Haasis. Leaf scorch is of considerable importance, especially along the South Atlantic seaboard.

Haasis undertook a study of the disease in 1949 at the Vegetable Research Laboratory near Wilmington. He selected bulbs of the Soleil d'Or variety from fields showing heavy leaf scorch infection.

The bulbs were then steeped in 0.5 per cent formalin at 110 to 110.5 degrees for intervals of one-half, one, two and four hours. Fol-

lowing treatment, the bulbs were stored in trays until planting on October 17.

The plants were examined on December 31 for primary leaf infections. The following percentage infections were found: 15.75 per cent for no treatment, 1.25 per cent for both the half-hour and one-hour intervals, 1.50 for the two-hour interval, and no infection where the bulbs were steeped for four hours.

Haasis concludes that Narcissus leaf scorch can be greatly reduced by steeping infected bulbs in hot formalin for as little as a half hour. It can be eradicated by prolonging the steep for four hours.

Low Fertility Reduces Bulb Flower Crop

Neglecting the fertilizer needs of narcissi one year will reduce the yield or cause the failure of the cut flower crop the following year. That's the report of J. M. Jenkins, Jr., who has been conducting nutrition studies with narcissi at Wilmington since 1947.

Bulbs planted on light, sandy soils produced few good flowers the second year and did not bloom at all the third year if they received no fertilizer. Bulbs that received 1500 pounds of 4-12-4 fertilizer per acre in three applications each growing season continued to produce good crops of flowers and

large bulbs over a period of three years. The use of 750 pounds of 4-12-4 per acre supplemented with a sidedressing of 190 pounds of nitrate of soda at the time of emergence also resulted in good yields.

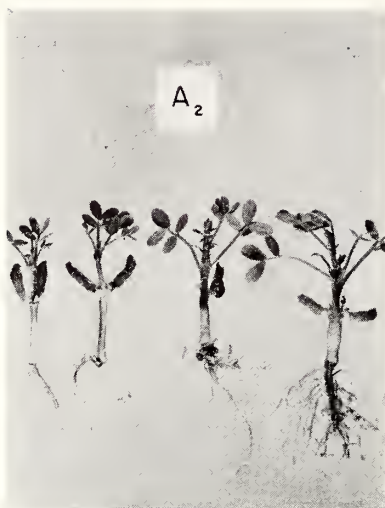
Jenkins cites an example to show that one year's fertilization determines, to a large extent, the next year's flower performance. Narcissi receiving a complete fertilizer application in 1948 produced satisfactory yields of flowers in 1949 when they were grown without fertilizer. But when these same bulbs were grown on well-fertilized plots in 1950 they failed to flower.

The narcissus bulbs on the left received no fertilizer for two years. Those on the right received 750 pounds of 4-12-4 fertilizer each year.





FIELD CROPS



Seedlings from X-rayed peanut seed (left and center) compared to a normal seedling of the same age (right).

New Peanuts Show Leaf Spot Resistance

New varieties of peanuts selected from high yielding peanut hybrids have outyielded present commercial varieties in 50 to 80 per cent of the tests conducted throughout eastern North Carolina during the last three years.

W. C. Gregory who is in charge of peanut breeding work reports that the new strains have a more satisfactory seed size and have fewer diseased seeds. They require a longer growing season to reach full maturity, but they are not too late to make a fine crop of peanuts.

One of the most outstanding features of these selections is their much improved resistance to leaf spot disease. Although leaf spot can be greatly reduced through appropriate dusting, it still constitutes a problem worth solving through plant breeding.

Another effort to develop varieties resistant to leaf spot is being made through the use of X-rays. X-rays create both permanent and temporary chemical changes in plants and animals. Sometimes these changes are so great that the individual dies. But also, the changes are sometimes just enough to affect the inherited characters.

Several bushels of peanut seed were shipped to the Atomic Energy Laboratories at Oak Ridge, Tennessee, where they were exposed in a one-million volt X-ray machine. Exposures ranged as high as 80,000 roentgens. To give some idea of this extreme exposure, Gregory points out that a human receives about two roentgens of exposure during an ordinary chest X-ray.

The exposed seeds were then

planted and kept under close observation. Many that were exposed to 80,000 roentgens failed to germinate at all. Those exposed to 5,000 or less showed little or no radiation injury. Exposures of 16,000, 18,500, 20,000 and 40,000 roentgens gave a wide range of damage. The leaves were usually flecked with white. Sometimes they were curled and twisted and sometimes apparently killed outright.

The nature of some of the temporary changes in peanuts caused by X-rays is shown in the accompanying photos. By growing the seed produced on these plants which are ill with radiation sickness, it may be possible to recover permanently changed offspring resistant to leaf spot.

FERTILIZER PLACEMENT AFFECTS PEANUT STANDS

Poor stands of peanuts may result from improper placement of fertilizers.

In experiments conducted by E. T. York at the Upper Coastal Plain Experiment Station, the stands of Virginia Bunch peanuts were reduced by more than one-half when fertilizers were placed in a band directly under the seed at planting. In contrast, fertilizers

placed in bands three inches on each side and two inches below the seed level had little effect upon germination. Neither were there noticeable effects when the fertilizers was placed in a band four to five inches below the seed in the row.

This experiment and a similar one conducted in Chowan County with the Jumbo Runner variety also indicate that it is safe and

effective to apply superphosphate in bands under or on each side of the seed with muriate of potash being applied to the top of the row as the plants begin to emerge.

Unless fertilizers can be placed on the side or at least four inches below the seed at planting it would be desirable to apply the potash as a top dressing some two to three weeks after planting.

Fumigants Limit Root Knot on Peanuts

Soil treatments to control root knot nematodes almost doubled the green weights of peanut plants over those grown on untreated soil.

W. E. Cooper undertook these soil treatment experiments in the late summer after finding severe root knot infestations in fields throughout the peanut belt. He selected for the tests a severely affected field on the Upper Coastal Plain Station at Rocky Mount.

All the plants including most of the roots were removed from the field in late July. On August 1 the rows were treated either with Dowfume D-40 or Dowfume N at 2.7 and 4.7 ml. per linear foot of row. Without disturbing the soil below the seed furrow level, Cooper planted peanut seeds in half of the rows on August 15 and the other half on August 24.

There was no apparent injury to the seedlings in either planting. Two months after the last planting, the plants were dug. The roots of plants from all of the treated rows were practically free of nematode galls, while those from untreated rows were severely affected as seen in the accompanying photo. The relative average green weight per plant, including tops and roots for the different treatments are shown in the table.

Cooper reports that the symptoms of root knot damage to pean-

nuts are severe stunting and dying, and roots that are discolored, short, matted with numerous small galls. The galls are from one to three times the diameter of normal roots, contain from one to four female root-knot nematodes and usually have several short stubby rootlets developing from them.

The relationship of this peanut root-knot nematode to others reported on peanuts is not known. But apparently it is not the same strain which commonly attacks tobacco and vegetables. Cooper believes this nematode may be one of the main reasons for poor plant growth—especially where peanuts follow peanuts in a cropping sequence.



These peanut roots were taken from soil that had been treated (left) and untreated (right) for root knot.

TABLE—The relative average green weight of entire peanut plants from treated and untreated peanut root-knot nematode infested soil—Upper Coastal Plain Station, Rocky Mount, N. C., 1949

Treatment	Rate ml. Per Lin. foot	Relative weights*	
		Planted 8/15/49	Planted 8/24/49
Dowfume N.....	4.7	149.5	139.3
Dowfume N.....	2.7	187.4	150.8
Dowfume D-40.....	4.7	195.8	175.4
Dowfume D-40.....	2.7	182.1	175.4
Untreated		100.0	100.0

* Soil treated August 1, and plants harvested October 24, 1949.

Engineers Seek Ideal Row Width for Growing Peanuts



An alternate row-spacing of 17 and 23 inches permits planting and cultivating with a three-wheel tractor.

What is the ideal row width for peanuts from all standpoints—yield, quality, fertilizer and seed used as well as ease of machine planting, cultivating and harvesting?

Johnny McCraney and G. W. Giles hope to have the answer to this question when they complete experiments started in 1949.

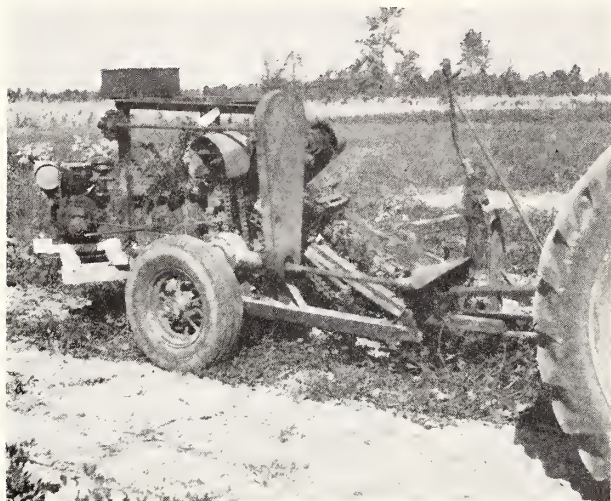
Earlier tests have shown that the yields of both peanuts and hay can be greatly increased by spacing the rows closer together than the 36 and 42-inch rows which are standard. One method tried during 1949 was an alternate spacing of 17 and 23 inches, adapted to the tricycle type medium-sized tractor.

A second method used was a uniform spacing of 18 inches, adapted to a light four-wheel tractor with the tread adjusted to 36 inches.

In each case, four rows at a time were planted or cultivated. Special attachments were devised so that four planters could be mounted on each tractor.

The maximum power required for the planting and for any one cultivation was five horsepower. This is not excessive for the tractors used. The rotary hoe was found excellent for early cultivation. Ten-inch sweeps were satisfactory for the later cultivations, provided they were set flat so that little or no soil was moved to the drill.

ENGINEERS COMPARE HARVESTING METHODS



The experimental once-over green peonuts horvester on the left uses belts for holding the plont while the nuts ore



stripped off. The model on the right allows only the lower portion of the plont to pass through the picker.

The best mechanized method now available to farmers for harvesting peanuts was tested during the 1949 season by G. W. Giles and Johnny McCraney who are seeking to improve peanut harvesting. The method consists of two separate operations: (1) digging, shaking and windrowing; and (2) picking with a semi-combine.

In the first operation, a two-row digger-shaker was found to be more satisfactory than a one-row machine since it combines two rows into one, reduces labor and keeps the tractor more nearly loaded to capacity. In the second operation, a semi-combine picker is pulled alongside the windrow, and the peanuts pitched into the machine by hand fork. If the weather permits, the peanuts may be left in the windrow to dry partially before picking.

Giles and McCraney found that this machine method required 13 man hours per acre as compared with 34 man hours by the usual method of harvesting. The picking time was three hours per acre—too slow to be considered practical. One acre per hour is considered a satisfactory rate for green peanut harvesting.

A further disadvantage of this method is the difficulty of saving the vines from a semi-combine picker. Also, the picker removes the leaves from the stems and mixes

soil and roots with the vines, thus making a lower quality hay.

The two investigators also continued work on three new types of peanut harvesting machines that are efficient and also promise to eliminate some of the disadvantages mentioned above.

The most promising of the three machines tried utilized belts or steel fingers which grip the plant by the top and convey it over strippers which remove the nuts. Following this operation, the roots are clipped off and returned to the soil while the tops are conveyed to a wagon.

The second method consists of two separate machine operations: (1) removing the plant tops and stubble; and (2) collecting and sifting the soil from the nuts. A considerable amount of trash is collected by this method, but it may be removed satisfactorily.

A machine, utilizing a third principal of operation, removes the lower portion of the plant for passage through a conventional type of peanut picker. The upper portion of the plant is conveyed directly to a wagon or returned to the soil. This method materially reduces the time required for picking.

These experiments will be continued in an effort to combine the most desirable features of these machines into a single, once-over peanut harvester.

ARTIFICIAL DRYING CAN GIVE PEANUTS OFF-FLAVOR

Under certain conditions, artificial drying may damage peanuts from a quality standpoint as shown in 1949 tests conducted by the Experiment Station. The most common types of damage are "off flavors," excessive splitting and skinning when the peanuts are shelled.

The speed of water removal in itself does not cause the off flavor if the peanuts have reached the proper cure before drying is started. The off flavor is not a result of fat breakdown, since free fatty acids and peroxide indices on bad tasting peanuts are generally lower than those for good tasting peanuts.

Peanuts can be dried in a vacuum from a moisture of 40 per cent to one of 8 per cent within nine hours. However, such rapid drying requires supplementary heat.

Where the peanuts have reached the proper cure, rapid drying does not produce any more damage than less rapid means of artificial drying.

Peanuts having vines removed two weeks before harvest showed lower yields when harvested by conventional methods. However, the quality of these peanuts when artificially dried was higher than where the vines were clipped at digging or one week before digging.

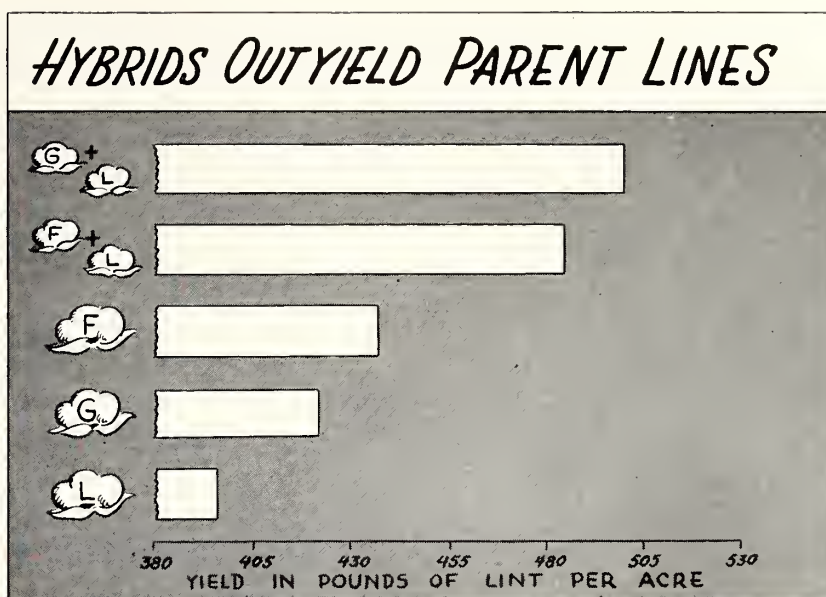
Cotton Hybrids Excell Parent Lines

Cotton hybrids have outyielded the best inbred lines by 18 per cent in tests conducted by P. H. Kime and H. F. Robinson. Ten of the 45 hybrids tested last year at the McCullers and Piedmont Stations showed higher yields than the most outstanding inbred strains.

The tests showed also that the fiber quality of a cotton hybrid is intermediate between that of the two parents. Hybrid fiber length, strength and fineness will be neither better nor poorer than those of its parents.

The two investigators believe that the increased yields warrant developing practical methods for producing hybrid cotton seed. Chief problem is cross pollination. While it's a fairly simple matter to control the pollination of corn by detasselling the female stalks, cotton poses a tougher problem. Male and female segments of the flower are located so closely together as to make it difficult to destroy one without injuring the other.

Without controlling the pollination, only part of the seeds ob-



tained would be hybrid—the result of cross-pollination with other plants. The remainder would result from self-pollination and thus would be inbreds.

Obviously, the amount of cross-pollinated plants in the resulting

mixture would have to be large for practical use. Beltwide estimates of the minimum required proportion of hybrids vary from 5 per cent in some parts of Texas to a little more than 50 per cent in Tennessee.

Breeders Increase Fiber Strength of Cotton

New triple hybrid cottons have been developed by Gladys F. West with fiber tensile strengths 50 to 60 per cent higher than their upland parent, Coker 100 Wilt. Other parents of the new cottons are a synthetic hybrid of an Asiatic species and an American wild species native to Arizona.

The best of the new line is some 50 per cent above the average of the best commercial varieties grown east of the Mississippi. In fact, its fibers are 15 to 20 per cent stronger than the best American Egyptian long staple cottons.

Miss West repeatedly backcrossed the new strain to a standard variety to increase the yields without losing the fiber strength. Now she is carefully separating the resulting strains. Fiber length ranges from 1.10 to 1.25 inches.

Fifteen pounds of cotton from

ten selected lines were spun into carded and combed yarns. Regardless of staple length, the strongest hybrids tested revealed 45 to 60 per cent higher yarn strength than the average of the best cottons grown east of the Mississippi.

They showed strength 10 per cent higher than our best American Egyptian stocks with a staple length of 1.5 inches. Miss West points out that shorter cottons with superior strength can produce better yarns than those spun from our best inch-and-a-half cottons.

Fiber length and strength are the two most important properties in determining yarn strength. It is possible to predict approximately the yarn strength of a cotton when the length and strength of the fibers are known. Strength is the most reliable test of yarn quality and a major requirement for many materials. Also, stronger yarns are de-

sired by the mills because they bring about "smoother running" during the spinning process.

The backcrosses will continue.

SODIUM BOOSTS YIELDS OF COTTON LOW IN POTASH

Greenhouse experiments using sand cultures have shown that under conditions of potash deficiency, sodium increased the yield of seed cotton.

In work conducted by O. R. Lunt and W. L. Nelson, cotton grown under slightly deficient potash conditions yielded 14 per cent more seed cotton when sodium was added. At a highly deficient level of potash, sodium increased yields 35 per cent. These increases in yields were mostly due to larger bolls.

Sodium had no effect on fiber length or strength. Plant analyses show that the cotton plant takes in considerably more sodium than any of the common crops such as corn or tobacco.

SOURCE OF NITROGEN UNIMPORTANT ON COTTON



The cotton on the left did not receive enough nitrogen while that on the right did. The yields were 1,475 and 2,563 pounds, respectively.

TREATED SEED ELIMINATES THINNING

By treating cottonseed with recommended fungicides, farmers may safely reduce their seeding rate, judging from experiments conducted by S. G. Lehman. In fact, treatment with such materials as Ceresan or Dow 9-B makes seed germination so dependable that farmers can eliminate thinning by using the correct seeding rate.

Lehman tested treated and untreated lots of all three types of seed—fuzzy, reginned and acid delinted—at the Upper Coastal Plain Station in 1949. Seed was planted by hand and by machine on April 26 and 27.

In one planting, four, six and eight seeds were dropped in hills spaced about 11.5 inches, representing seeding rates of approximately 11, 16 and 22 pounds per acre.

Where the treated seed were counted and dropped by hand, fuzzy seed treated with Ceresan gave much better emergence and survival than either reginned or acid delinted seed. Where four, six and eight fuzzy seeds were planted per hill, the percentages of missing hills were 5, 2 and 2, respectively. The percentages of missing hills planted with acid delinted seeds at

the same rate were 14, 11 and 10, respectively. Further thinning of these stands did not significantly effect the yields of seed cotton.

In plantings made with a regular cotton planter, treated fuzzy seed again resulted in better emergence than did reginned or delinted seed.

Leguminous cover crops or commercial nitrogen fertilizer serve equally well to bring maximum cotton yields, say C. D. Welch and W. L. Nelson. A seven-year check in the upper Coastal Plain section shows that the method of supplying nitrogen is unimportant.

Welch and Nelson found that cotton needs about 60 to 80 pounds of nitrogen to produce maximum yields on average soil. Cotton fields supplied with too little nitrogen yielded only 1,475 pounds to the acre. Those given enough nitrogen, on the other hand, yielded 2,563 pounds of seed cotton per acre.

Part of this yield increase may come from the formation of more five-lock bolls. The scientists separated four and five-lock bolls to check the influence of nitrogen on the number of locks. Not only were there more five-lock bolls among the plants given 80 pounds of nitrogen as compared to those without nitrogen, but the bolls were 20 per cent heavier.

As another phase of the experiment, Welch and Nelson tested non-legume cover crops. They found it necessary to apply additional nitrogen to the cotton crop following oats and rye grass which had received heavy nitrogen top-dressing.

The two rows on the left were planted with untreated seed. Seed for the third row was treated 13 days and for the fourth row, 53 days before planting.



Soybean Breeding Stock Increases



This photo illustrates the actual process of cross-pollinating soybeans.

DUST SOYBEANS TO INCREASE YIELDS

Dusting soybeans with 7 per cent copper to control diseases increased the yields an average of 22 per cent in two tests conducted by S. G. Lehman.

The experiments were conducted at the McCullers and Plymouth Stations, using three varieties—Ralsoy, Ogden and Roanoke. Lehman used two dusts, one containing 7 per cent copper and 3 per cent DDT and another containing only 3 per cent DDT. Seven applications were made at 14-day intervals between July 11 and September 23.

At McCullers, copper plus DDT increased the yield of Ralsoy by 5.4, Ogden by 4.6 and Roanoke by 7.3 bushels per acre over plots dusted with DDT alone. At Plymouth the increase was 3.8 bushels with Ralsoy, 5.9 with Ogden and 8.2 bushels per acre with Roanoke. The average increase for the three varieties in the two tests was almost 6.0 bushels per acre or 22 per cent above the yield from plots receiving only DDT.

In a similar test at Rocky Mount, the use of copper with DDT increased the average yield of three varieties by 4.2 bushels or 15 per cent.

Lehman found that dusting reduced leaf spotting diseases from 25 to 50 per cent on Ralsoy which is very susceptible. He found comparatively little bacterial infection on plots of Ogden and Roanoke, regardless of whether they had been dusted. He concludes that the increases which resulted from dusting with copper apparently were not due entirely to control of the bacterial diseases.

CORRECT POTASH DEFICIENCY WITH SIDEDRESSING

Sidedressing with potash at the first appearance of potash deficiency symptoms significantly increased the yield of soybeans in an experiment conducted by C. D. Welch, N. S. Hall, and W. L. Nelson.

In this test, conducted on a Bladen silt loam low in potash, the symptoms developed about one month after planting. There was no significant difference in yields regardless of whether the potash was placed in bands, broadcast or applied as sidedressings.

The effects of placement with potash differed greatly from those

For almost 40 years after soybeans were introduced to North Carolina in 1903, the only improvements came as a result of selecting from outstanding foreign varieties. Some varieties developed in this manner possessed one or more good characters, but all lacked many of the characters desired.

In 1941, soybean breeders began the time-consuming task of trying to bring together into one variety the desirable characters possessed by all existing varieties. This is possible only through carefully controlled hybridization.

In the first phase of this breeding program, crosses were made so that one parent was strong in at least one character while the other parent was strong in a different character.

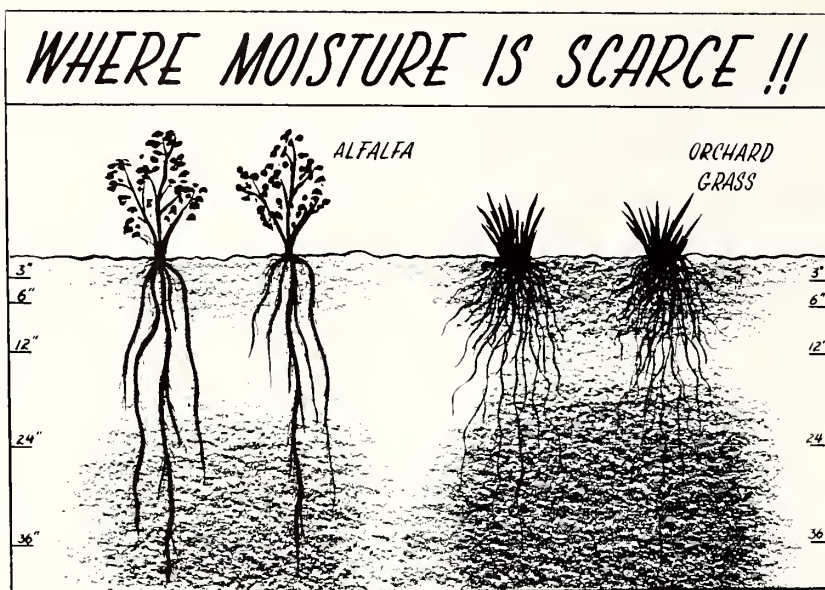
During the second breeding cycle, crosses were made between strains that possessed the best combination of the desired characters. By 1949, according to H. W. Johnson, the second cycle was near completion. Better breeding material is now available than ever before.

Expansive screening of over 19,000 F_3 progenies from 128 different crosses has revealed strains with good combinations of yield, oil content, and resistance to diseases, shattering and lodging. None of these strains has been tested enough to determine if it merits release as a new variety.

of phosphorus placement. In this same test, the soybeans made more growth and seed yields were higher where the phosphorus was applied in bands three inches to the side of the seed instead of being broadcast. The greater solubility of the potash fertilizer salts accounts for this difference, the investigators explain. Phosphorus fertilizer materials move very little after they are put in the soil.

Even though broadcasting or sidedressing the potash gives as good results, it is more economical to apply it in bands at planting along with the phosphorus.

A Grass Roots Study of Soil Moisture



LOW POTASH STUNTS ALFALFA ROOTS

Alfalfa stands often "thin out" rather suddenly on soils low in potash. At one cutting the stand and yield may be good, and yet by the next cutting, many plants may have been replaced by weeds.

Why? Not all the reasons are apparent on the surface. But a look below the surface by W. W. Woodhouse, Jr. and J. H. Horton showed that the roots held the answer. In this experiment, low potash cut the yield of roots more drastically than it did top growth. Without application of potash, the alfalfa roots grown on an acre weighed 997 pounds, while the top growth weighed 1,800 pounds. An application of 150 pounds of K_2 per acre

boosted the root growth to 3,330 pounds and the top growth to 3,272 pounds.

Woodhouse and Horton say this isn't surprising since potash is known to be essential in the manufacture and transport of foods within the plant. When there is a potash shortage, the leaves produce less food and then have "first call" on food that is produced. Little gets down to the roots. Consequently, the roots starve first and may be in bad shape before the top of the plant indicates trouble.

This is just another argument for keeping track of the nutrient level of your soil by soil tests. Then don't let the supply get too low.

BREEDING IMPROVEMENTS SPEED BETTER LESPEDEZAS

Improvements in crossing techniques promises to speed up the development of better lespedeza strains from the descendants of Korean lespedeza.

C. H. Hanson explains that the trouble until now has been the difficulty of transferring pollen on the delicate and showy, rose-colored flowers. Recent improvements, however, have solved much of the problem, and more rapid progress can be expected in the future.

Attempts to cross a second type of flower which also grows on the lespedeza plant have not, as yet, been successful. These flowers bear no visible petals and do not open. They are so small that they may go unnoticed.

In spite of their small size and unusual appearance, they are responsible for much of the lespedeza seed crop. Hanson believes they may account for nearly all seed formed during cool weather.

Agronomists have literally gotten down to the grass roots to answer the question, "Just how much water does orchard grass and alfalfa need for maximum growth?" What they have learned about water requirements of these hay and pasture plants should prove helpful to farmers and agricultural scientists alike in planning fertilization and irrigation.

D. S. Chamblee found that soil under alfalfa was dryer throughout the season than under orchard grass at all depths. Under both alfalfa and orchard grass soil dried to the wilting point more frequently at the 12-inch depth than at any other. Chamblee and his associates conclude that there are many periods during the growing season when the water supply is insufficient for good growth of even a deep rooted plant like alfalfa. Roots of both orchard grass and alfalfa, the scientists found, extended into the soil a maximum of 36 inches.

The agronomists used a special moisture measuring machine—the Bouyoucos earphone bridge—to learn how plant roots affect soil moisture content. Earlier studies in other areas had shown that alfalfa needs a tremendous amount of water for maximum growth. Estimates placed the needs at from 500 to 1,000 pounds of water to produce one pound of alfalfa hay.

In setting up this experiment, Chamblee buried gypsum blocks beneath the alfalfa and orchard grass plants. These soil moisture blocks—connected to the electrical measuring device—were placed at depths of 3, 6, 12, 24 and 30 inches.

Readings of soil moisture at all depths were then taken on 55 days between April 21 and September 30. On 70 per cent of the 55 reading dates, the soil was near the wilting percentage at the 12-inch level under alfalfa. However, it reached this dryness on only 30 per cent of the days at the 3- and 30-inch depths. The reason for the difference, Chamblee says, is that the upper level of soil was replenished by light showers, while the lower level contained fewer roots.

ALFALFA STAND LOSSES HEAVY IN LATE SUMMER

North Carolina needs an alfalfa that will live longer than the commercial varieties now grown. Station scientists are trying to develop such a plant and recent discoveries of harmful fungi have given them encouragement in their search for hardier strains.

C. H. Hanson and J. Lewis Allison made stand counts on a number of strains in six yield tests to learn the causes of alfalfa stand losses. Tests were made near Raleigh and Smithfield during 1947-'48 and '49. The investigators counted stands after the second hay crop harvest and again when plants reached a growth of 6 to 10 inches after the final cutting.

The most critical period, they found, was late summer and early fall. In this season many plants died and others partially weakened and dying plants and found two harmful fungi which attack the crown buds and root systems of alfalfa.

One was *rhizoctonia solani*, a fungus which was found consistently in blighted and dead crown buds with normal-appearing root stems. Many plants were so severely dam-



The variety growing in the center row of this alfalfa test plot was completely eliminated by disease during the late summer and early fall.

aged that they could grow no more from the top.

In plants with yellow and wilted stems the plant scientists found a root fungus—*fusarium oxysporum medicaginis*. Affected roots showed irregular, brown rotted areas penetrating downward from the crown region.

Among the 266 strains tested for signs of harmful fungi, some showed fewer losses and more productivity, while others suffered severe stand losses during the same period. The fact that there are differences in resistance to fungi encourages the researchers to experiment further.

Oversize Bales Interfere with Artificial Drying of Hay

Relation of bale size to weight is an important factor in barn drying of baled hay. Bales too heavy for their size fail to cure well or produce good quality hay. Improperly dried bales can cause heating.

J. W. Weaver, C. D. Grinnells and S. H. Usry have had the best results with artificial drying when moisture accounted for 35 to 40 per cent or less of the weight of the bale before drying. For instance, a bale 14 by 19 by 36 inches should weigh no more than 60 pounds before drying. This permits hay to dry to the required moisture content of 18 to 20 per cent for safe storing.

Artificial drying tests with light and heavy bales showed that those containing 60 per cent or more moisture weighed about 95 pounds after drying. Light bales, contain-

ing about 35 per cent moisture before drying weighed only 60 pounds after barn drying. Only 40 per cent of the heavy bales made good hay, while 92 per cent of the light bales produced good quality forage.

In these experiments, 47 tons of baled alfalfa were dried in the new crop drying building at Central Farm in Raleigh. Hay was placed on the slatted drying floor of the building to a depth of five bales. Air was forced up through the bales at an average rate of 22½ feet per minute. At night and on rainy or damp days, the air was heated to 120 degrees F.

The average moisture content of the hay before drying was 40 per cent. The average after drying was 18 per cent. The operating cost averaged \$3.81 per dry ton with electricity at two cents per kilo-

watt hour and fuel oil at 11.9 cents per gallon.

The investigators offer several hints as to how farmers can lower the moisture content of hay to be baled. Hay cut a day or two after a heavy rain must dry on wet ground—a condition that slows hay drying. Clouds covering the sun and trees at field edges slow drying.

Machinery is another important factor in getting uniform bales for drying. Weaver, Grinnells and Usry found the tractor mower valuable because it speeds up cutting and has all the hay drying and ready for baling sooner after cutting. Because it makes a looser, more uniform windrow, the side-deliver rake is more suitable than the dump rake. When properly adjusted, the pick-up baler makes just as uniform bales as the hand-fed baler.

Engineer Lists Factors In Successful Drying Of Loose Hay in N. C.

Loose hay should contain no more than 20 per cent moisture at the time of storing says J. W. Weaver, who has completed intensive studies of hay harvesting in all seasons. With that moisture percentage quality will be good and there will be no danger of heating.

Weaver finds that it takes about 3¼ tons of standing green hay to produce a ton of properly cured forage. Since most legumes and grasses contain about 75 per cent moisture at the time of cutting, around 4,400 pounds of water must be removed from each ton of hay before storage. Hay stored the same day it is cut, he says, cannot be dried properly without the use of artificial heat.

While rate of drying is affected by other such factors as yield, soil moisture and weather, Weaver says season is a very influential factor. In 1949 he tested the drying rate of alfalfa in the swath and considers the results typical of other years.

If the weather is favorable alfalfa cut about the middle of May and left in swath all day will lose 65 per cent of the water that must be evaporated for safe storing. In contrast, eight hours of field drying in June, July or August will remove from 90 to 94 per cent. Five times as much water is evaporated in the first hour after cutting as is removed during the fourth hour.

Hay will seldom dry to below 30 per cent moisture content in one day Weaver found. When left in the field overnight, it takes until 10 o'clock the following morning for the hay to become as dry as it was the previous afternoon. Drying thereafter is slow, but by 3 or 4 o'clock of the second day the hay is down to 20 per cent moisture content and can be stored safely. Hay cut in the early spring and fall must be dried in the field at least three days before it can be stored.

Hay that is to be baled tightly and stored in bulk should be dried to 12 or 15 per cent moisture content before baling.



Small grain pasture (left) mires much more readily under fall grazing than does a properly managed Ladino clover-archard grass pasture (right).

Permanent Pasture Solves Miring Problem

Providing animal feed during late fall and winter months is a real problem. To help solve it, many North Carolina farmers have turned to grazing small grain. While this is a worthwhile practice in many instances, the farmer often runs into difficulties.

One problem is that cattle tend to mire on small grain during the long wet periods which often occur during late fall and winter months. This miring and packing of soil has rightly caused much concern.

There are several solutions to the problem, the best of which is La-

dino-grass pasture. According to R. P. Upchurch and E. U. Dillard, animals will not mire on a properly managed Ladino-grass pasture. If growth is allowed to accumulate during early fall, Ladino-grass will furnish excellent late fall and winter grazing.

In replacing small grain for grazing with Ladino-grass, farmers should remember that small grain planted in the fall will be ready to graze in a few weeks. On the other hand, Ladino planted at the same time will not be ready for grazing until the next spring.

Oats Ahead of Corn Boosts Yield of Forage

Bottom land used to grow a crop of oat hay ahead of the regular corn crop produced one-half ton of dry matter per acre more than did land used for corn alone in tests at the Mountain Experiment Station. A research team headed by R. K. Waugh and W. W. Woodhouse is investigating this and other means of growing more forage on the limited areas of bottom land found in the Mountains.

Letoria, a winter-hardy variety of oats, was used in this study. Plots of bottom land were given the following treatments: (1) continuous corn for silage; (2) oats, grazed and (3) oats, hay or clipped. An effort to determine the yield of oats for Treatment 2 was not successful.

The dry matter yields per acre for corn were: Treatment 1, 3.4 tons; Treatment 2, 2.7 tons; and Treatment 3, 3.4 tons. The yield of oats for Treatment 3 was 0.6 tons per acre on a dry matter basis.

"The longer you live with a person the more you find out about him," say Waugh and Woodhouse. "So it is with Ladino clover. Most of what we have learned about this clover has been favorable. Now we know that Ladino-grass will furnish good late fall and winter grazing without danger of stock becoming mired or packing the soil. Here is another of the many advantages of growing the plant of green gold—Ladino clover."

Bumper Yields at Piedmont Station

North Carolina farmers can more than double their average yields of small grains simply by following all of the improved practices recommended by the Experiment Station, says W. H. Rankin.

Rankin bases this statement on the results from farm-size fields of wheat, oats and barley during 1949 at the Piedmont Branch Experiment Station.

Eighty bushels of oats per acre on a twelve-acre field is not a record high yield, says Rankin, but it is two and a half times the State's highest average annual yield per acre. Likewise, 637 bushels of wheat produced on 18 acres or 35 bushels per acre is double the State's highest average annual yield per acre.

In the case of barley, a yield of 66 bushels per acre on 14 acres is almost two and a half times the State's average yield.

On this basis, applying the findings of research to North Carolina's present acreage of small grains would increase the State's wheat crop by almost ten million bushels, the oat crop by 20 million bushels and the barley crop by almost two million bushels.

ATLAS WHEAT WITHSTANDS DISEASE

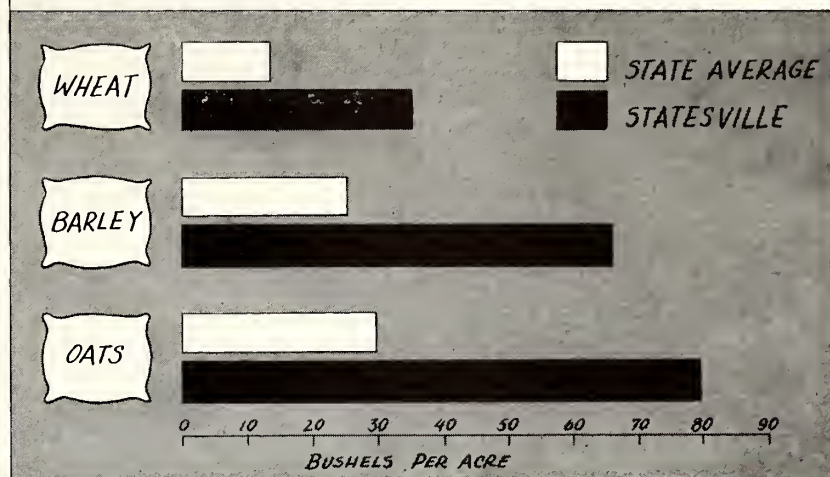
Atlas 50 and Atlas 66, two new wheats developed by G. K. Middleton and T. T. Hebert, stood up well through the rather severe epidemics of both powdery mildew and leaf rust following the mild winter of 1948-49. Both wheats have resistance to these diseases and have exceptionally stiff straw.

Though members of the North Carolina Foundation Seed Producers and North Carolina Crop Improvement Association produced approximately 8,000 bushels of seed in 1949 this fell far short of demand.

In nine tests conducted on the McCullers and Piedmont Branch Station farms in the past five years, these two strains of Atlas have averaged 31.9 bushels per acre. The variety most widely grown in

SMALL GRAIN YIELDS

DOUBLE THE STATE AVERAGE



Arlington Oats Released to Growers

The new Arlington oat variety released to North Carolina farmers in the fall of 1949 has an outstanding yield record and is resistant to many of the oat diseases which occur in this state, according to G. K. Middleton and T. T. Hebert.

Arlington was developed from a cross of Lee-Victoria and Fulwin by workers in the Division of Cereal Crops, U. S. Department of Agriculture. It was tested and named cooperatively by this division and several state experiment stations.

The following average yields for 16 Official Variety Tests conducted in North Carolina over a three-year period indicates its superiority to commonly grown varieties.

Variety	Bushels per acre
Arlington	94.6
Stanton	79.4
Letoria	74.7
Victorgrain	73.2
Fulgrain	68.2
Lee	61.8

Arlington is resistant to all races of rust and most races of smut which are common to North Carolina. It also has good resistance to mosaic.

The new oat is slightly more winterhardy than Victorgrain and Fulgrain and about as hardy as Letoria. It is a little taller than the commonly-grown varieties and has a fairly stiff straw. An abundance of fall growth also makes Arlington a valuable variety for grazing.

the State has averaged only 21.1 bushels per acre. If this performance could be duplicated on the third of a million acres expected to be planted to Atlas by 1951, the State's wheat crop would be increased by one and a half million bushels.

Colonial barley, another recent release of the North Carolina Station, produced the highest average yield among all barley varieties in 40 Uniform Trials conducted throughout the winter barley area. Colonial averaged 46.4 bushels per acre as compared with 29.4 for Sunrise.

The low average yield of Sunrise was apparently due to rust damage. Colonial, while not highly resistant, has some tolerance to this disease.



Thousands of small grain fields show symptoms of lack of nitrogen during late winter and early spring. The above photos of wheat, oats and barley plants contrast seedlings receiving no nitrogen (left) with those receiving 12 pounds of nitrogen applied at planting time. Note how low nitrogen limits the number of tillers (potential seed heads).

Oat Blight Appears for First Time

Helminthosporium blight of oats was reported for the first time in North Carolina from Hyde County in the spring of 1949.

A survey of the county by T. T. Hebert showed that blight was present on only a few farms, but it was doing considerable damage in these cases. The disease was not found in any other part of the State.

Helminthosporium blight has been quite destructive in the Deep South and in the spring oat areas of Central and Eastern United States. It has not been nearly so severe on the northern edge of the

winter oat belt where North Carolina is located. Hebert believes this is due primarily to temperature, since the disease is favored by warm temperatures.

All of the rust-resistant varieties now being grown in the State—Fulgrain, Victorgrain, Arlington, Lectoria and Stanton—are susceptible to blight. Varieties resistant to this disease, including Lemont, Lee and Fulghum, are susceptible to rust.

Beginning in 1948 with 335 early generation lines from some 50 crosses, Hebert is attempting to develop new varieties resistant to both of these diseases.

Small Grain Breeders Score Heredity Factors

The age-old problem of heredity-vs-environment must still be taken into consideration by the plant breeder. When he selects outstanding plants to start a new and better variety, how can he be sure these plants are genetically superior rather than merely showing vigor from having been grown in a favorable environment?

G. K. Middleton, R. E. Comstock, H. F. Robinson and A. T. Wallace began experiments in 1949 to study the relative importance of heredity and environment in the case of oats. Though the study is not yet complete, the investigators report the following partition of variations in five different plant characters:

Character Studied	Heredity Percentage	Environmental Percentage
Yield	9.1	90.9
Plant Height	20.4	79.6
Culm Number	8.1	91.9
Number Seed Per Plant	9.1	90.9
Weight Per Seed	14.4	85.6

As the table shows, less than 10 per cent of the variation in yield is due to heredity. This means that if a small grain breeder selected one plant over another because of its higher yield, less than 10 per cent of the differences in yield would be due to heredity, and over 90 per cent would be due to environmental variation.

FLAX DOES NOT COMPETE WITH GRAIN IN PIEDMONT

Although flax can be produced successfully in North Carolina, W. H. Rankin doubts that present prices and yields justify its production in competition with wheat, oats, or barley.

Records on seed flax over the past three years show that yields of from 12 to 20 bushels per acre can be expected. The tests were conducted at the Piedmont Experiment Station near Statesville.

In a field planting similar to that which might be used in commercial production, Rankin harvested 17 bushels per acre. Identical soil receiving the same fertilization produced 35 bushels of wheat, 80 bushels of oats or 66 bushels of barley per acre.

Seed flax varieties under test at the Piedmont Experiment Station.



Off-Farm Storage Helps Corn Market

The recent increase in commercial or off-farm grain-drying and storage facilities has already helped stabilize the market for corn and small grain in North Carolina, reports Sidney H. Usry. North Carolina which for years has exported grain in the fall and imported it in the spring may soon satisfy its markets locally. Another benefit is the reduction of losses due to moisture and insect damage.

The first commercial drier was erected in eastern North Carolina in 1949. During 1949, five new driers were erected in connection with both old and completely new storage facilities. The rapid increase in corn yields is largely responsible for this sudden expansion. The State's corn crop totaled over 75 million bushels in 1949—an increase of 42.2 per cent over the 1938-47 average.

With enough drying and storage facilities, North Carolina farmers could harvest their crop earlier in the fall and thus avoid the severe infestations of rice weevil and Angoumois grain moth. It is not definitely known at what time these infestations start, but it is believed that the weevil does not attack corn while it is still high in moisture.

In 1949 tests, corn that ranged from 19.8 to 23.2 per cent moisture was dried artificially. Samples showed little weevil activity as compared to field-dried corn.

By building two drying bins alongside his flue tobacco barn, J. Clay Idol of Kernersville was able to dry seed corn for five cents a bushel.



This new grain drying and storage building has a storage capacity of approximately 80,000 bushels with a 300-bushel per hour drier in the rear.

Farmer Dries Corn in Tobacco Barn

The method of drying seed corn with a converted flue tobacco barn as developed by John W. Weaver, Jr. and S. H. Usry, has been put to good use by J. Clay Idol of Route 1, Kernersville, N. C.

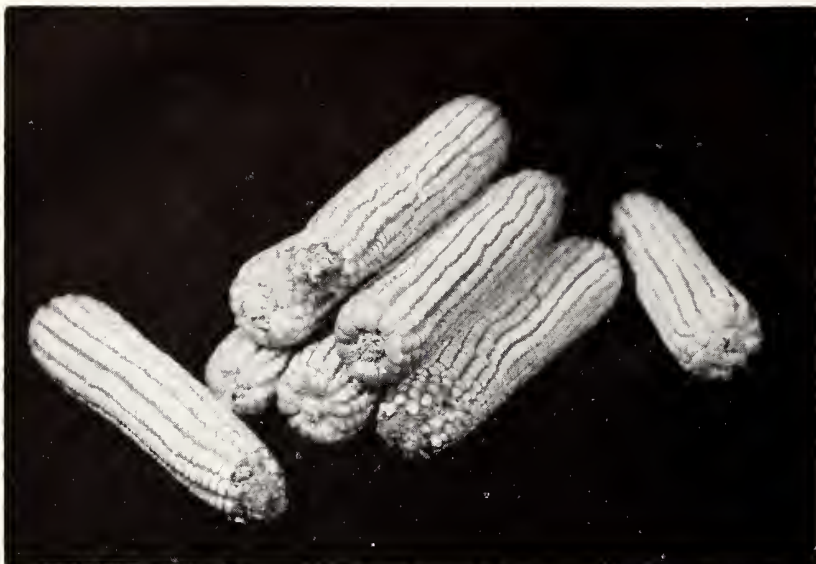
In 1949, two drying bins of cement block construction were added alongside a log barn which was built about 1900. The stoker-fired furnace provided ample heat for

drying about 500 bushels of seed corn during the fall of 1949.

Three days of drying were required to drop the moisture content of a bin full of corn from 26 per cent to 13.6 per cent. The operating cost averaged five cents per bushel with stoker coal at \$18.50 per ton and electricity at two cents per Kilowatt hour. The dried seed was readily certified, and tests showed germination as high as 100 per cent.

A 24-inch fan draws heated air from over the flues and forces it up through the drying bins. The shed, concrete floor, drying bins, fan and one h.p. motor cost \$760 to build and install. Since the capacity of this system is about 800 bushels in three weeks, the investment cost amounts to 95 cents per bushel of capacity.

The barn is used to cure tobacco during the summer and to furnish heat for drying seed corn in October. Detailed plans for building a tobacco barn dryer may be obtained by writing to the Extension Agricultural Engineer, N. C. State College, Raleigh.



These are typical ears of NC8106, an experimental white-cobbed white corn.

New Hybrids Yield Well in Tests

Three experimental white corn hybrids developed by P. H. Harvey have averaged 24 per cent more erect plants at harvest time than Dixie 17, the standard white hybrid. However, the experimental lines have not produced as much grain as Dixie 17 during the past two years of testing in the Piedmont and Coastal Plain.

The new hybrids have been designated NC8104, NC8105 and NC8106. All have pure white kernels on white cobs. NC8104 which tends to be a two-eared variety has medium sized ears. NC8105 has similar plant and ear characteristics, while NC8106 has large ears and is mainly a one-eared type.

Harvey reports that this latter hybrid appears to be highly resistant to *Physoderma zae-maydis*, a disease commonly called "brown spot." Foundation seed stocks are being increased with the expectation of releasing at least one of them in the near future.

North Carolina's northern mountain area requires varieties of corn which ripen early even with cool temperatures. In tests at Laurel Springs, two new yellow hybrids, NC8037 and NC8046, have produced from 15 to 40 per cent more grain than locally grown farm varieties.

P. H. Harvey and H. L. Cooke who conducted the tests report that

the new hybrids have matured earlier than the native varieties as measured by the amount of moisture in the grain at harvest time. The experimental hybrids have averaged 27 per cent moisture in the grain at harvest as compared with 32 per cent for the farm varieties.

In the same tests, three white hybrids, NC8108, NC8109, and NC8112, produced very high yields of grain. However, the white hybrids were not as early maturing as the new yellow hybrids and could not be grown at the higher elevations.

NEW INBREDS WILL AID FOUNDATION SEEDSMEN

NC37, one of the inbred parents of the white hybrid, Dixie 17, is very susceptible to the disease, *Helicoverpa*. As a result of disease attacks, seed producers have experienced some difficulty in producing foundation seed stocks for the widely used white hybrid.

J. B. Pate and P. H. Harvey report new inbred lines which have proved highly resistant to the disease in tests.

During 1949, the new inbreds were tested for yield and other characteristics in test crosses. Most of them proved equal to or better than NC37 in grain yield, lodging and grain quality.

Fertilizer Mixtures Fail to Stop Billbugs

Mixtures of insecticide and fertilizer applied to the row at the time of corn planting failed to control corn billbugs in tests conducted by Walter M. Kulash.

Materials used in these tests included DDT at 5 pounds per acre, lindane at 0.2 pounds, parathion at 0.5 pounds and chlordane at 2 pounds. Billbugs emerge from hibernation over a six-week period starting at or before the time corn begins to break through the ground. They feed at the base of the stem and at the tip of the plant.

Under such conditions of long-term emergence and locality of feeding, says Kulash, it is not surprising that the insecticide-fertilizer treatments did not control the pests. The best control of billbugs in 1949 tests at the Coastal Plain Experiment Station near Willard was obtained with seven applications of 5 per cent chlordane dust at 25 to 30 pounds per acre applied at five-day intervals. Lindane, 1.5 per cent dust, applied in a similar manner, was next best.

Wireworms, another pest that frequently destroys young corn stands, also were not controlled with the fertilizer-insecticide treatments.

POPULAR CORN HYBRIDS ALSO TOPS FOR SILAGE

Corn hybrids that are popular for grain in North Carolina also proved best for ensilage during two years of testing by H. L. Cooke. Cooke compared the hybrids with so-called "ensilage" varieties.

NC27 hybrid produced a high total tonnage and a high grain percentage in tests from the lower mountains all across the State. Dixie 18, under favorable growth conditions in the Piedmont and Coastal Plain, produced more total pounds of ensilage per acre and a higher percentage of grain than any other entry.

Dixie 17 produced good yields of high quality ensilage in all parts of the State except the upper mountain area. U. S. 282 produced the most high quality ensilage in the upper mountain area.



The plant on the right was treated with mineral oil to control suckers, while that on the left was untreated.

Mineral Oil Controls Tobacco Suckers

The search for a growth-regulating chemical to control suckers in tobacco took an unexpected turn in 1949 when one of the so-called "carriers" under test proved more effective when used alone than when combined with the "active ingredient." Ordinary mineral oil is the material that showed such promise.

D. B. Anderson explains that of the hundreds of mixtures tested during 1947 and 1948, alpha naphthalene acetic acid (ANA) offered the most promise. But since it was unnecessary as well as too expensive to apply this material at full strength, Anderson directed his 1949 studies toward finding a media in which ANA might be dissolved or suspended before applying it to tobacco plants.

He tested a wide variety of materials — liquids, pastes, creams, emulsions and solid pellets — and tried various concentrations of ANA in each. Two carriers—heavy mineral oil and solid pellets—proved superior to any of the others.

The most successful results were obtained by suspending 5 grams of ANA in 95 grams of heavy mineral oil. The mixture was applied to a

small hole punched in the end of the severed stem. The oil penetrated the plant tissues for a short distance and there released the ANA in large enough amounts to check the growth of the lateral buds for about three weeks. Plant injury was slight unless the end of the stem was split as the cavity was prepared.

The pellets which successfully controlled sucker growth contained 20 mg. of ANA mixed in a clay binder. A single tablet was pushed into the top of the severed stem. When the pellets contacted the moisture from the crushed cells, they disintegrated and released the ANA. While this method did not give as complete control of sucker growth as the mineral oil suspensions, there was less danger of injuring the plant.

As a check to these experiments, pure mineral oil was applied to other plants. Some of these control plants failed to develop any suckers, while others produced as many as topped, untreated plants. An examination of these plants showed that sucker growth was inhibited only when the mineral oil ran down

the outside surface of the stem.

Extensive trials were then carried out at four locations, using mineral oil alone. About 1 cc. of Squibbs' Heavy Mineral Oil was brushed on the upper two or three inches of the severed stem, and the oil was permitted to run down to the lateral buds. In every trial, the buds covered with mineral oil died and turned black within 24 to 28 hours. There was no apparent injury either to the stem or the leaves, the leaf quality appeared unaltered.

Subsequent tests by farmers and research workers showed that mineral oil was just as effective in checking bud growth in burley as is flue-cured varieties. Anderson concludes that in view of the uniform success on all varieties studied, the complete absence of injury and the low cost of treatment, mineral oil alone is far more promising as a means of controlling sucker growth than any other compound so far studied.

Promising as it is, however, it cannot be recommended for general use until it has been tested more thoroughly.

Pigment, Sugar Changes During Cure

Two important and rather extensive chemical changes in leaf composition take place during the normal curing of flue-cured tobacco. First, the green or chlorophyll pigments are destroyed, and second, the starch is converted to sugar.

As the green pigments are destroyed, the yellow pigments are unmasked. The operator uses this color change as a guide for regulating the curing process. While color, in itself, contributes very little to tobacco quality, it serves as an important guide for evaluating cured tobacco on the warehouse floor. On the other hand, the conversion of starch to sugar cannot be followed visually. But it is highly desirable to develop the maximum amount of sugar during curing, since the quality of tobacco is directly related to its sugar content.

These two changes during curing have been studied separately, but no experiments have been reported in which they were followed simultaneously. A. B. Pack undertook to fill this gap in knowledge of the flue-curing process by conducting an experiment designed to correlate the transformation of starch to sugar with the change in pigments.

Leaves of 402 variety harvested at three stages of maturity and representing each of the cutter and body classes were subjected to normal curing. Samples were withdrawn from the curing barn at eight-hour intervals during the first 48 hours of curing and at 24-hour intervals during the final 48 hours.

These samples were then analyzed for pigments, starch, sugars and dry matter.

Pack found the pattern of pigment changes to be essentially the same as reported by other investigators. Chlorophyll was lost very rapidly during the first 40 to 48 hours, but much slower after that time. In general, over-mature leaf yellowed in 30 to 36 hours, mature leaf in 40 to 48 hours and immature leaf in 50 to 65 hours.

There was a rapid decrease in starch content during the first 48 hours of curing, and this was accompanied by an equally rapid increase in the content of reducing sugars and total sugars and a much slower but steady rise in the sucrose content. The maximum concentration of reducing sugars was attained in 30 to 40 hours of curing, that of total sugars in 40 to 48 hours and of sucrose in 60 to 70.

After development of the maximum amount, there was a steady and fairly rapid decline of the reducing sugars, a relatively small decrease in total sugars and a slight loss of sucrose during the remainder of the cure. Starch was diminished to a minimum content within 40 to 48 hours of curing and remained virtually unchanged during the rest of the operation.

Pack concludes that the transformation of starch to sugar and the pigment changes are two independent processes in progress at the same time, and a high degree of correlation exists between them.

Ripening Agent Slows Tobacco Flue-Curing

A gaseous compound known as ethylene has been used for several years in the ripening of bananas and other fruits. Since the changes that take place in ripening fruit are similar to those that occur during the curing of flue-cured tobacco, it seemed worthwhile to investigate the possibilities of using a ripening agent to speed up the flue-curing process.

A. B. Pack chose to conduct the tests with 2,4-D weed killer which has been used successfully as a ripening agent for bananas. Using tobacco of the 402 variety, Pack cured by the standard procedure alone in one test. In a companion barn he added the methyle ester of 2,4-D in vapor form during the cure. The chemical was vaporized on a hot plate and allowed to diffuse into the heated barn atmosphere. The tobacco was sampled at frequent intervals and analyzed for pigments, starch and sugar.

The results showed that the presence of chemical vapors had a tendency to hinder or slow down the curing as compared to the usual or standard method. Both observations and chemical analyses agreed that the use of 2,4-D retarded the yellowing. The rate of conversion of starch to sugar was not speeded up by the 2,4-D vapors.

As for quality, the cured tobacco from the normal cure was considered somewhat superior because of higher sugar content and less green pigment.

Chemical Sucker Control Does Not Detract from Leaf Quality

The use of growth regulators to control tobacco suckers has posed the problem of whether the chemicals have any effect on the curing and quality of tobacco from treated plants.

To secure this information, A. B. Pack conducted a test in which he charted the pigment and carbohydrate changes during the curing of tobacco from both treated and untreated plants. The changes have an important influence on quality and afford a means of studying the progress of the curing.

Alpha naphthalene acetic acid was the growth regulator used in these tests. Applied to the stem apex of "topped" plants, it was effective in inhibiting sucker growth for three weeks. In the same period, the non-treated plants required suckering twice. Leaves from the treated plants were longer, wider and had more area and fresh weight, on the average, but they matured more slowly.

Pack cured the treated and non-treated plants by standard methods, withdrawing samples from the

barn at periodic intervals. These were analyzed for pigments, sugar and starch.

The results showed that aside from the delay in maturing, tobacco from treated plants yellowed satisfactorily and yielded a cured leaf acceptable in color. The transformation of starch to sugar was not adversely affected. The sugar content was slightly less than that of similar tobacco from hand-suckered plants, but was still high enough for satisfactory quality.

BOTTOM SPECIAL, 402 LEAD IN VARIETY TESTS

The State's tobacco variety testing program, begun at the Rocky Mount Branch Station in 1946, has now been expanded to include all six of the tobacco research farms and experiment stations. According to W. E. Colwell, this is the first time that facilities have been available for state-wide testing of tobacco varieties.

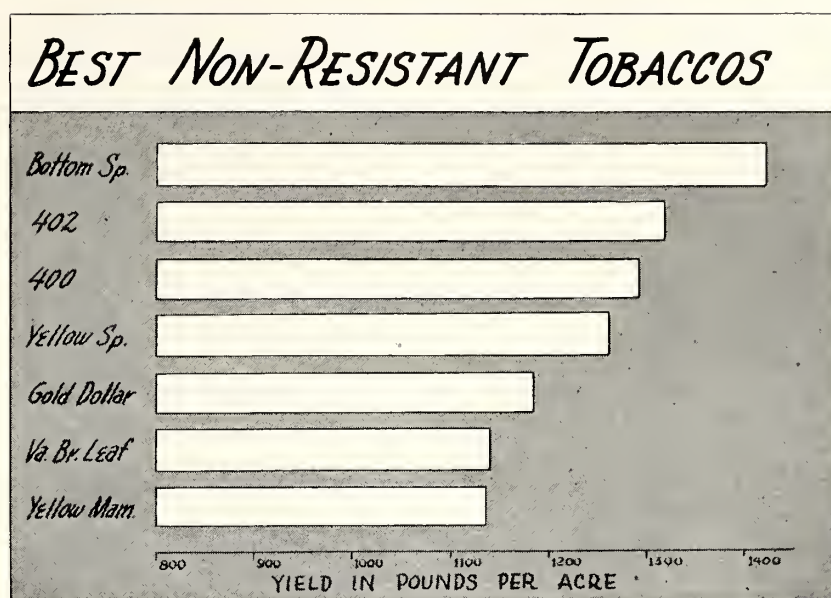
The Station's entire staff in tobacco research participates in this program in one way or another.

The Bottom Special variety was recommended for certification on the basis of its performance in these tests. The new Dixie Bright disease resistant varieties were also evaluated in these tests from the standpoint of yield and quality.

Growers often ask the question, "What variety should I plant?" Most of them are accustomed to the answer that if they have a disease problem, their choice of varieties is somewhat limited. Judging from the results of the variety tests, the grower with disease-free soil is also limited in his choice if he is striving for top performance. The results presented in the accompanying figure show very clearly the superiority of the broad leaf varieties over such other varieties as Gold Dollar, Virginia Bright Leaf and Yellow Mammoth.

The performance of 402 has continued to be outstanding in these tests. Its high value is due not only to a high yield, but also to a high proportion of the better cigarette grades of tobacco. The comparison between Bottom Special and 402 is a particularly interesting one. Bottom Special has out-yielded 402 by 100 pounds in these tests. Yet, their values are approximately equal, leading one to conclude that the quality of 402 is higher than that of Bottom Special.

W. G. Woltz says that chemical and grade analyses reveal just that. Bottom Special produces a high proportion of the heavy, leafy type grades, particularly on the heavier soils and under high rates of fertilization. Growers should confine this variety to the thinner, less fertile soils.



DIXIE BRIGHT VARIETIES RELEASED

Three new disease-resistant varieties of tobacco were released in December, 1949 as a result of extensive tests conducted by E. L. Moore and G. B. Lucas. The three new strains were selected from a field of 25—four with resistance to Granville wilt and black shank and 21 with resistance to wilt.

One of the new varieties—Dixie Bright 27—has resistance to Granville wilt only. At ten locations during 1949, Dixie Bright 27 produced tobacco having an average value of \$726 per acre. In companion plots, the standard Granville wilt resistant variety, Oxford 26, produced tobacco having a value of only \$549 per acre.

Dixie Bright 101 and Dixie Bright 102 are resistant to both wilt and

black shank. At 11 locations, Dixie Bright 101 produced tobacco having an average value of \$751 per acre. At 14 locations, Dixie Bright 102 produced tobacco having an average value of \$514 per acre. The latter variety, while not so heavy a yielder, has high resistance to both diseases and excellent quality as well.

An unusual method of release was adopted to get seed of these varieties into the hands of farmers who needed them in time for the 1950 crop. Normally, there is a one-year delay between the time of release and the time seed becomes available to growers. In 1949 the Experiment Station was able to produce a limited amount of seed of the Dixie Bright varieties for direct release.

Fumigants Reduce Root Knot in Plant Beds

Studies on control of diseases and weeds in the plant bed by E. L. Moore and G. B. Lucas showed that soil fumigation with methyl bromide gas applied at 1 pound per 10 square yards in the early spring controlled weeds, black shank and reduced root knot. At double the above rate root knot was controlled.

Methyl bromide solution (15 per

cent by volume in Xylene) emulsified in water and applied as a drench (255 ml. per gal. per sq. yd.) was effective against weeds and black shank but not root knot. However, when chloropicrin was added to this emulsion (85 ml. per gal.) root knot was controlled.

All plots receiving these treatments produced uniform plants.

Blue Mold Control Chemicals Stimulate Growth of Young Plants



Fungicides protected the plants on the right from blue mold damage.

Crop Rotations Check Nematode Diseases

Thirteen years ago experimental plots were established at the McCullers Station to investigate the effects of various crop rotations on the control of root knot and other nematode diseases. This experiment, which is still in operation, has provided valuable information on the behavior of these diseases and their influence on yield and quality of tobacco.

Two, three and four-year rotations have been tested, according to F. A. Todd. Crops alternated with tobacco in the two-year rotation include cotton, corn, weeds, peanuts and oats followed by weeds. In the three-year rotations, tobacco has been followed by corn-cotton, cotton-peanuts, peanuts-cotton, corn-oats-weeds, cotton-weeds, peanuts-oats-weeds and weeds-weeds. Corn-cotton-peanuts-tobacco was the cropping sequence in the four-year rotation. The check plots have been planted to tobacco every year.

The results thus far reveal that crop rotations play an important role in keeping nematode diseases of tobacco in check. In the plots planted to tobacco every year, the root knot index has remained high, and the tobacco has been severely

damaged in years favorable for the disease.

In most of the two-year rotation plots, the root knot disease index remained rather high but fluctuated considerably for about the first five years. The peanuts-tobacco rotation reduced the index somewhat sooner than the others. Since 1944, however, root knot indices in all of the two-year rotation plots have been consistently far below those of plots in which tobacco was grown every year.

All of the three-year rotations gradually reduced the incidence of root knot to low levels with the cotton-peanuts-tobacco rotation bringing it down more sharply than the others. As in the case of the two-year rotations, there was a lag.

The four-year rotation has been highly effective. Root knot was markedly reduced by 1940, and since 1943 there has been no infection of consequence on tobacco grown in this rotation.

From these results, Todd concludes that all rotations have been superior to continuous tobacco culture. He warns, however, that where root knot has become a serious problem, the use of rotations may not give immediate relief.

The primary purpose for treating tobacco plant beds with Fermate or Dithane is to protect the young plants from blue mold disease. Tests conducted at the McCullers Branch Experiment Station by F. A. Todd indicate that these two materials may also increase the growth of plants—especially on beds that have received the Uramon-Cyanamid treatment for weed control.

In 1949, Todd tested Fermate at two different rates of application and Dithane Z-78 at one rate on both untreated and combination treated soils (1 pound Uramon plus $\frac{1}{2}$ pound Cyanamid applied in the fall) at two levels of nitrogen fertilization. Unsprayed check plots were also included.

The blue mold control chemicals stimulated the growth of the seedlings in each case. Fermate both at the low (4 pounds per 100 gallons of water applied twice a week) and high (4 pounds per 100 gallons of water applied four times a week) rates increased the growth on all plots that had received the combination weed control treatment. The difference was much greater with high Fermate, however.

Dithane Z-78 spray (3 pounds per 100 gallons applied twice a week) had an even more pronounced effect on the growth of plants than either the low or high Fermate treatments. On beds receiving the combination treatment, the plants sprayed with Dithane weighed nearly twice as much as unsprayed plants.

Todd also noted that beds receiving the combination treatment, but no nitrogen (1 pound 0-9-3 per square yard) produced heavier plants than the same treatment receiving nitrogen (1 pound 4-9-3 per square yard). Where no nitrogen was added to the plant beds, the sprayed plants weighed more than those in the check plots. On beds receiving no weed control treatment and no nitrogen, there was little evidence of increase in growth due to either Fermate or Dithane.

HIGHEST YIELDS RESULT FROM BAND PLACEMENT

Fertilizer placed in bands six inches apart and four inches deep produced the highest yields and values of tobacco in fertilizer placement tests conducted by S. L. Tisdale. The studies were made at three locations: the Border Belt Tobacco Research Farm near Whiteville, the Oxford Branch Station, and the Upper Piedmont Tobacco Research Farm at Rural Hall.

Tisdale tried out three methods of placement in these tests—(1) fertilizer placed in one band right under the plant and not mixed; (2) fertilizer placed in one band and mixed; and (3) placed in two bands.

Several other combinations of placements were also tried, among which was the so-called split application. In this instance, part of the fertilizer was placed under the plant and the remainder applied as a top dresser about three weeks after planting. In other tests, the fertilizer was divided into its various components, and they were placed in different locations with respect to the plant. None of these treatments, however, looked as promising as placing the complete fertilizer in two bands.

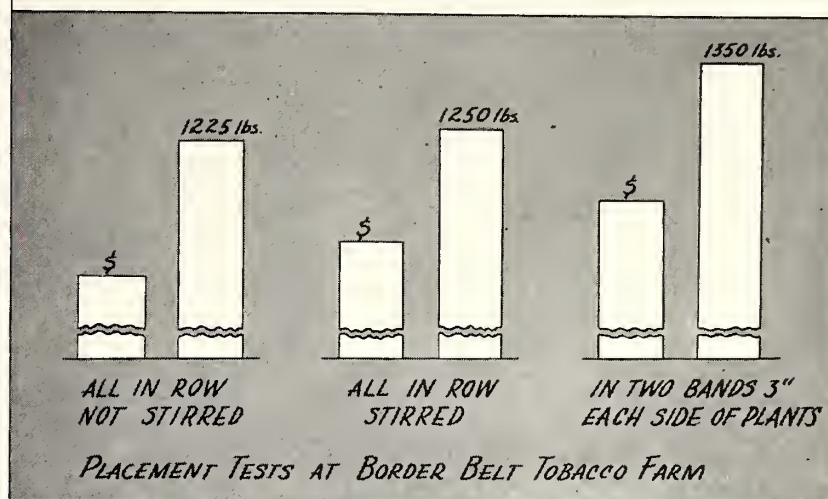
Tests with radioactive phosphorus conducted by W. G. Woltz and N. S. Hall verified Tisdale's results. Their results also showed a greater utilization of the applied phosphorus when it was placed in bands six inches apart and four inches deep.

ROOT SYSTEMS VARY

How do tobacco roots behave in different types of soil? The full answer to this question is not yet known, but from what S. L. Tisdale was able to find during the 1949 season, tobacco roots don't behave the same in all sections of the State.

Several factors probably affect root growth among which are prevalence of root knot, soil texture and depth of top soil. Generally speaking, Tisdale found that those areas in which root development is good, tend to have higher yields.

PLACE TOBACCO FERTILIZER IN BANDS



Excess Fertilizer Reduces Quality

Excessive rates of fertilizer under tobacco simply do not pay, though they normally give a larger plant frame and sometimes a higher yield. W. G. Woltz reports that in practically every experiment where excessive fertilization has increased the yield, the increase has been more than off-set by a decrease in quality.

Nitrogen is the element that must be watched closely. In addition to increasing the nicotine and decreasing the sugar in the leaf, excessive nitrogen increases the calcium and other bases in the leaf. This is bad because a tobacco high in calcium and other bases does not make good cigarettes.

In fact, the calcium content of the leaf is more closely associated with the amount of nitrogen than with the amount of calcium in the fertilizer. In one set of plots, the soil was limed to pH 6. Tobacco grown on these plots with 30 pounds of nitrogen contained only 3.33 per cent calcium as compared to 3.67 per cent calcium in the tobacco grown with the 60-pound rate of nitrogen on the non-limed soil.

Woltz summarizes as follows the results of fertilizer experiments

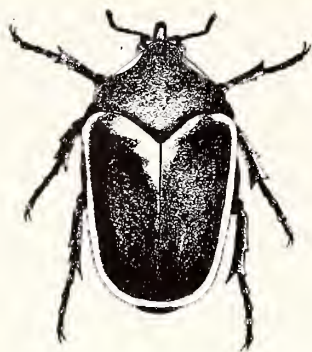
with varying rates of nitrogen, phosphorus, potassium, calcium, magnesium, sulfur and chlorine, over the past three years. The sugar and nicotine in the leaf varied with the amount of nitrogen applied. Variations in the amount of the other elements applied had little if any influence on these two compounds.

This appears more or less to disprove the old theory "that the effects of high rates of nitrogen can be partly overcome by applying more potash and phosphorus."

The type of leaf produced was also greatly influenced by the amount of nitrogen applied. Potash and chlorine appeared to be the elements controlling the burn of the leaf—another important property of good cigarette tobacco. The addition of potash improves the burn of the leaf, although 60 to 90 pounds of potash per acre appeared to be plenty. Chlorine had the opposite effect of potash on burn.

Approximately 90 to 110 pounds of calcium (about 125-150 pounds of CaO) in the fertilizer appeared to be about right. The addition of 90 pounds of P₂O₅ per acre in the fertilizer resulted in a more uniform and quicker growth.

Parathion Improves Grubworm Control



Grubworms (right) are the larvae of the green June beetle (left).

Several of the newer insecticides give better control of grubworms in tobacco plant beds than does poison bran bait—the standard remedy for many years. Henry Townes reports that 1 per cent parathion dust at 1 pound per 100 square yards was outstanding among the materials tested.

Grubworms are the larvae of the green June beetle. During July and August, the beetle deposits its eggs in the ground where there is good plant cover or little on the surface. The grubworms from these eggs live in the ground but come to the top to eat decaying vegetable matter.

The pests may uproot and kill a large portion of the small plants in a tobacco bed. Where the plant bed is located on newly cleared ground or where the plant bed is clean-cultivated in the summer grubworms are seldom serious. But the current trend is toward permanent plant bed sites which are often planted to a dense cover crop or grows up in weeds during the summer. These conditions favor grubworms, and their destructive-

ness is increasing with the widespread use of permanent sites.

Since clean cultivation is not always practical, farmers have been forced to use other means of control. Before 1949, the most common formula was a mixture of 25 pounds of wheat bran, two pounds of paris green and enough water to moisten. This provided enough bait to treat 200 square yards. It was scattered in the bed in the late afternoon. Under good conditions, it would kill up to 75 per cent of the grubs.

A few farmers started using parathion for grubworms in 1949, Townes reports. However, dealers were not accustomed to requests for this material so early in the season. Hence, the supply was short.

The big labor saving in using parathion, says Townes, is that it can be dusted through the plant bed cover. The bait treatment requires taking off the cover.

The comparative costs and efficiency of bait and parathion are as follows:

	Cost of Materials per 100 Sq. Yards	Labor (minutes) per 100 Sq. Yards	Per Cent Kill Expected
Bait	\$.90	45	65
Parathion15	15	90

Prior to 1949, none of the new organic insecticides was recommended for the control of tobacco insects by Station entomologists. Investigations showed that many of them would give cheaper and more efficient control, and recommendations for their use were included in an Extension Circular published in May, 1949.

These recommendations have been very successful and are rapidly being put into practice by farmers.

Polistes Wasps Seen As Foe of Hornworms

Polistes wasps which are common all over North Carolina are thought to be a major factor in the control of tobacco hornworms. It is known that they attack caterpillars almost exclusively.

To determine the role of wasps in the control of hornworms and budworms on tobacco, R. L. Rabb undertook a study of their habits and prey.

His findings to date include the following:

1. The seven species of *Polistes* in the State have different feeding habits. Some prefer to hunt for caterpillars in woods, others in fields or fence rows.
2. Individual wasps seem to find a certain place and certain species of plants to hunt on and tend to stay with these places and species.
3. About 30 caterpillars a day are brought in to an average-sized wasp nest.
4. The greatest hunting activity seems to be in July.

DDT, PARATHION MAKE QUICK WORK OF MIDGES

The larvae of midges and crane-flies take a heavy toll of tobacco seedlings in plant beds each spring. Destruction is sometimes so complete that reseeding is necessary.

For about 15 years, farmers have been controlling these pests by scattering moth flakes over the beds at 1½ to 2 pounds per hundred square yards. Experiments by Henry Townes have shown that 5 per cent DDT dust and 1 per cent parathion dust at 1 pound per 100 square yards are more effective, cheaper and easier to use because they can be put through the plant bed cover.

Townes gives the following comparison of time and efficiency for each method:

	Labor Per 100 Sq. Yds.	% Kill Expect- ed
Naphthalene	45 Min.	85
DDT	15 Min.	95
Parathion	15 Min.	99



CONSERVATION

Pond Pine Best Adapted for Pulpwood



This is one of the few good stands of sawtimber at Hoffman Forest.

Pond pine stands in Hofmann forest appear to be much more profitable when grown for pulpwood in a short rotation of 35 to 40 years than when grown in the longer rotations required for producing sawtimber.

C. M. Kaufman, Henry G. Posey and John B. White base this conclusion on growth data collected on 318 trees in the Forest. The test trees were classed by five-year age groups from five to 100 years.

Preliminary averages taken from the data indicate that pond pine in Hofmann Forest has an average height of 25 feet at 15 years of age, 34 feet at 25 years, 42 feet at 35 years, but only 48 feet at 50 years. In ages beyond 35 years, height

growth is very irregular. The rate of diameter growth also decreases in the older age classes.

On the most favorable sites, the investigators found a few stands of good sawtimber with volumes of 10 to 20 thousand board feet per acre. The Forest as a whole, however, appeared better adapted to the shorter pulpwood rotation.

Continued fire protection, or the use of controlled fire rather than wild fire, will doubtless improve the conditions for good growth. The possibility of site improvement by drainage has not been investigated. Some drainage is being provided in Hoffmann Forest, and data on the effect on site and tree growth will be forthcoming as the time required for natural changes passes.

Tract Leased for Cattle-Timber Tests

The possibilities of integrating cattle and timber production in the Tidewater area will be explored on a tract of forest land leased in 1949 by the North Carolina Experiment Station. The 2,000-acre

tract is located about seven miles south of Columbia in Tyrrell County.

E. U. Dillard and W. O. Shepherd who are in charge of the project plan to investigate the use of grazing for fire protection and pine regeneration as well as problems of cattle and timber management.

The tract is covered with pond pine stands of varying ages. The main forage is cane or "reed" which forms a rather uniform stand over the entire acreage.

About one-third of the area has already been inventoried and divided into experimental ranges. Eight such ranges are to be used in the first grazing experiment beginning in January, 1950. Some 20 miles of fences, facilities for weighing and handling cattle and for storage of feed and supplies were completed in 1949. Linwood Simmons, a native of Tyrrell County, has been employed as superintendent and foreman.

Previous experiments have indicated that cattle and timber production might be mutually beneficial. Grazing keeps down the brush and undergrowth which constitute a fire hazard. Also, switch cane has

Foresters Study Seeding Habits of Pond Pine

Though only about half of the cones on a pond pine contain seed, healthy trees from 30 to 60 years of age produce from 12,000 to 16,000 annually, according to C. M. Kaufman, Henry G. Posey and John B. White.

In making this study at the Hofmann Forest, Kaufman and his associates collected seed from 71 sample trees ranging in age from less than 10 to over 60 years. Trees selected on the basis of their apparent ability to produce cones were felled and an accurate count made of all cones.

The study showed that pond pine is deceiving in appearance as a seed producer. The cones on this species remain closed for a year or more after maturity before they open and release the seed. Thus, from casual examination, a tree

may seem loaded with seed when actually only about half the cones are mature and unopened. The remainder have opened, are wormy or died before maturing. Even so, seed trees from 30 to 60 years of age have an average of 150 to 200 mature unopened cones with approximately 80 seeds per cone.

Cones collected in this study were classed as 1948 crop, 1947 crop, 1946 crop and older. At present, the seed are being tested for viability to determine the vigor of sprouting and first season survival under nursery conditions.

Pond pine is the predominant species at Hoffmann forest and in the surrounding region—mainly because it is the only species that can resist the type of burning common in this area. Pond pine respond comparatively soon after fire.

GRAZING REDUCES PINE STANDS

A woodland management problem of growing importance in North Carolina is that of promoting the generation and development of pine trees in the face of increasing competition from hardwood species.

C. M. Kaufman and E. U. Dillard are investigating the possibility that cattle under the proper grazing system might tend to browse, "walk down" or otherwise damage the hardwoods, thus increasing the competitive advantage of the pines.

Preliminary results from a study started in 1949 indicate that heavy grazing does greatly reduce the height growth and crown spread of the hardwoods. However, the number of hardwoods was not materially decreased by one year of grazing.

On the other hand, over half of the young pine seedlings disappeared as a result of grazing. Year-old pine seedlings are so small that cows will take them along with other forage. Unlike young hardwoods, pine seedlings do not send up new sprouts to remain as part of the stand.

Two five to six-acre areas that had been cut over in 1948 were

used in this study. Young hardwoods varying in density to over 5,000 trees per acre covered the areas. Pine reproductions had seeded in stands varying from 500 to 1,000 trees per acre.

Six cows were turned into each area in April after the new growth on the more common trees was six to ten inches long. This grazing load, large for the areas, resulted in heavy overgrazing by the end of four weeks. Since most of the forage was gone and the cows were beginning to lose weight by this time, they were removed to improved pasture. After three weeks to permit regrowth, the animals were again turned on for a second four-week period. Again they were removed for three weeks and returned to the woods for a third period of four weeks.

One group of cows received one pound of protein supplement per cow per day while in the forest, while another group received no supplement. For the three grazing periods—April 12 to May 3, May 31 to June 28, and July 26 to August 12—the cows receiving no supplement lost an average of 1.10 pounds per head per day. Those receiving the supplement lost only 0.10 pound.

New Laboratory Speeds Research In Wood Use

Completion of a wood products laboratory, equipped with a modern forced-circulation dry kiln, now permits a rapid expansion of wood utilization research, reports Roy M. Carter.

The kiln is now equipped with balances, ovens and an electronic potentiometer for accurately determining drying conditions and the effect of drying upon the quality. Fifteen kiln charges have been run to develop rapid and safe schedules for drying pine, cypress and poplar.

Another important addition to the laboratory is a portable sawmill complete with power unit and edger. It permits studies on sawing methods, the place of the portable sawmill in manufacturing lumber, the methods and merits of sawing to grade, and procedures for sawing more uniform lumber.

Preservative treatments for fence posts and timbers are being tested in a new farm-size, hot-and-cold-bath treating plant. Using three different treating methods, two types of preservatives and several wood species, 150 posts have been marked for permanent service records to determine the effectiveness of each method.

NEW OVEN PERMITS STUDY OF MOISTURE IN VENEER

A special oven which permits determination of moisture content of veneer throughout the drying process is facilitating the study of veneer drying, according to James S. Bethel. Bethel is investigating the effect of such factors as temperature, exposure time, humidity, air circulation, veneer thickness, initial moisture content, species and heart or sap condition.

Drying tests have been conducted on 260 lots of veneer. These represent five domestic hardwoods, one domestic softwood, one African hardwood and thirteen Central American hardwoods. Seven thicknesses of veneer were included in the tests.

This lumber is being prepared for drying in the College's new dry kiln.



SIXTH OF SQUIRRELS INFESTED WITH WARBLE FLY

Approximately one out of six (17.4 per cent) of the gray squirrels examined in hunters bags by game protectors during the 1949-50 season (October 1 to January 1)

were infested with the warble fly larvae and considered unfit for food, reports Ray Allison and F. S. Barkalow, Jr. The survey of bagged animals is part of a continuing

study of warble fly infestation in North Carolina.

The 1949-50 infestation was slightly higher than that for the preceding year when 13.2 per cent of the animals checked were infested.

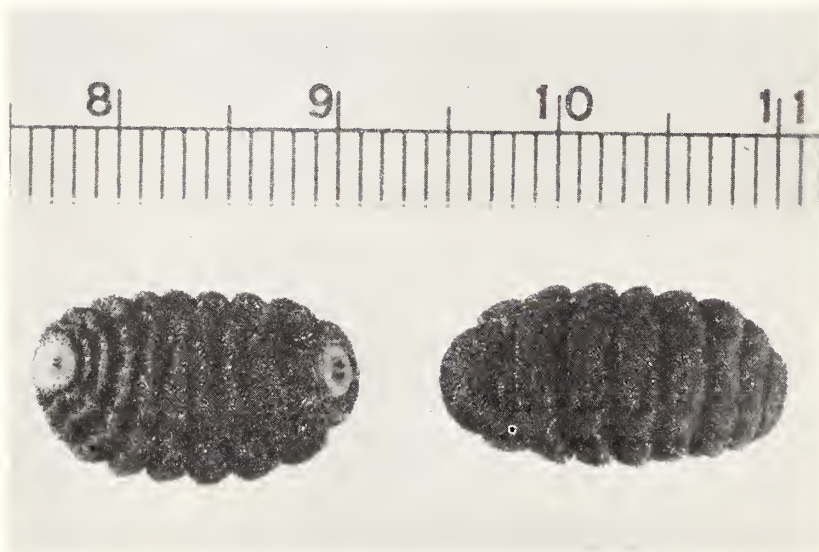
As may be seen from the accompanying table the period between September 1 and October 15 is the most critical time for warble infestation.

There could be a great saving in animals discarded because of warble infestation by setting the opening of the squirrel season back to a later date. Another reason for a later hunting season is that it would save many young squirrels from starvation when their mothers are killed during an early season. Enough data are not yet available to determine the extent of such losses.

During 1949, Allison continued the live trapping and tagging of gray squirrels on the Yates Pond area. Nest boxes were erected on the research area to determine their effect on the carrying capacity of the major types of farm wood lots.



Many gray squirrels killed in late summer are infested with larvae.



These are dorsal and ventral views of the warble-fly larvae.

Warble Fly Infestation of Gray Squirrels

Date	No. Squirrels Killed	No. Infected	Percentage Infestation
Sept. 1-14	8	2	2.8
Sept. 15-30	11	6	8.5
Oct. 1-14	23	9	12.8
Oct. 15-31	19	3	4.2
Nov. 1-14	7	0	0
Nov. 15-31	2	0	0

SUMMER SEASON BEST FOR AIR-DRYING POSTS

The season of March through October is the most effective for air-drying fence posts and similar wood materials, says Roy M. Carter. This conclusion is based on an analysis of weather data records for the five years 1944-48.

Carter determined the exact amount of time required to air-dry fence posts of three to four and five to seven-inch diameters during April and May. He found that peeled poplar, pine, ash, hickory and oak posts in well aerated piles will dry to 20-25 per cent moisture content (suitable for preservative treatment) in as little as 20 days.

Similar information should be compiled for other seasons of the year as a guide for fence-post treating plants.

Sod Cover Reduces Erosion, Run-off



Each watershed is planted to different crops.



Measuring devices record the water run-off.

Two storms measured near Waynesville during 1949 demonstrated how valuable a good sod cover can be in preventing erosion and in promoting absorption of rainfall by the soil, reports M. J. Gilbert.

The measurements were made on one of several watersheds being used by the Experiment Station and T.V.A. in a cooperative study of rainfall, runoff and erosion. The site is typical of farm land in the mountains of western North Caro-

lina with an average slope of better than 25 per cent.

A storm on May 8, 1949, was probably one of the most intense that would be expected in this area, Gilbert reports. Streams overflowed their banks and did considerable damage to bottom land. Slopes planted to corn were damaged. The intensity was as high as six inches per hour. Of the 2.74 inches that fell, 2.20 inches ran off. However, there was no visible erosion on the watershed in pasture.

Much more rain fell during a second storm on June 16, but the intensity was less. Of the 4.10 inches that fell, only 0.55 inches ran off. The rest was absorbed in the soil. The obvious conclusion is that it was not the total rainfall which was most important in producing runoff, but the intensity.

Gilbert concludes that good pasture even on slopes as steep as many of those found in western North Carolina is practically erosion proof.

COVER CROPS MAY NOT SERVE DUAL PURPOSE

It is difficult to use winter cover crops both as green manure crops and as a deterrent to erosion on sandy loam tobacco land, reports T. L. Copley and Luke Forrest.

In tests at the Soil Conservation Experiment Station near Raleigh, winter cover crops when turned early reduced summer erosion only slightly. Delayed turning of growth which was more mature and more resistant to decomposition gave somewhat better results.

A good growth of rye turned early in 1949 reduced erosion less than 10 per cent below no winter cover. Turning the rye late, at heading time reduced erosion about 25 per cent below no cover.

A third method—that of leaving part of the cover crop in the row middles as a mulch—gave considerably better results, reducing erosion nearly 75 per cent below no winter cover.

In this method, the tobacco row area was plowed by bedding when the rye winter cover was at the early turning state. An undisturbed balk six to twelve inches wide was left in the row middle on which the rye continued to grow. The tobacco was planted and cultivated normally in the 3 to 3½-foot row area.

Copley and Forrest point out another consideration in using winter cover crops. About 80 per cent of

the annual soil loss comes during the three months of June, July and August. This is the period when crop cultivation and heavy rains come together and is the period when erosion control practices are needed most.

In some cases, these heavy rains come so late as to interfere with the seeding of cover crops. Where no winter cover is seeded, the undisturbed grass and crop residue may protect the soil more than newly seeded cover. Taking a cue from this protection, Copley and Forrest suggest leaving a moderate amount of crop residue on the surface in preparing land for winter cover or small grain.

SOIL TYPE AFFECTS RATE OF LIME REACTION

To get maximum benefits from added limestone, recommendations concerning the use of lime should take into account the soil type, says A. Mehlich.

As an illustration, Mehlich cites experiments in which coarse limestone (20 to 40 mesh) reacted as quickly on Alamance silt loam as did finer material (80 to 100 mesh) on Georgeville clay loam. In greenhouse experiments, cotton and swiss chard made better growth at first in Alamance than in Georgeville soils. After five months had passed, however, this difference disappeared.

The explanation, says Mehlich, lies in the type of clay minerals composing the clay fraction of these soils. The clays of Alamance soil are more acid in character.

Tests on Cecil and Creedmoor soils provide another example of the influence of soil on lime response. This study was conducted with swiss chard and turnips in outdoor frames. Lime was placed in the subsoil four inches below the surface.

The plants responded considerably more to the four-ton lime application on Creedmoor than on Cecil soil. Without the added limestone, the growth on Creedmoor was very poor even though the pH was the same as that of unlimed Cecil. The similarity of clay minerals in Cecil and Georgeville probably accounts for the similarly poor crop response to liming.

In another experiment, limestone of varying degrees of fineness was added to one light and one heavy-textured soil. Ladino clover plants grown in these soils were found to absorb less calcium where the coarse limestone was used. Growth was better from the finely ground limestone (less than 100 mesh) on the sandy soil, but little difference was observed in the case of the heavy soil.

All these results show that the proper degree of fineness depends upon both the crop and the soil. More efficient liming practices depend on a better understanding of these relationships.



Dwight Kaster (left) and Gene Goldston comprise the Duplin soil survey team.

Soil Survey Started in Duplin County

The soil survey of Pasquotank County was completed and a similar study started in Duplin County during 1949. The surveys are being done cooperatively by the Division of Soil Survey, U.S.D.A., the Soil Conservation Service and the Agricultural Experiment Station.

A. E. Shearin, J. P. Covington and J. H. Vaden who conducted the Pasquotank survey report that Pasquotank soils more nearly resemble those of the eastern shore areas of Virginia and Maryland than the soils further south in North Carolina. Most Pasquotank County soils, though poorly drained, have light gray surface color and fine-textured profiles. Many are underlain at 28 to 40 inches by friable sandy material, permitting better natural underdrainage and wider use for cultivated crops.

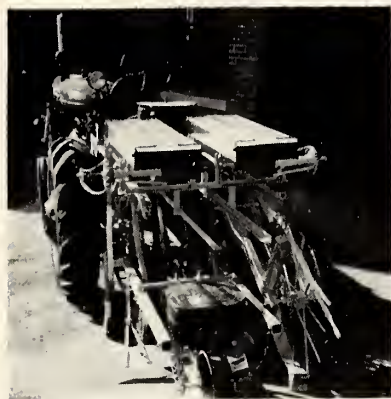
Soils of 24 series were recognized and mapped. These, in turn were separated into 65 types and phases. Although not a true soil, the largest unit-separate is peaty muck which covers 24 per cent of the county. Only a very few acres of peaty muck have been farmed because of the great difficulty in drainage and the resultant fire

hazard when drained.

The more extensive soils in Pasquotank County and Elkton which comprises about 13.5 per cent of the total area in the county; Bayboro, comprising 8 per cent, Pasquotank, 5 per cent; and Bladen, 3 per cent. When artificially drained, all these are good agricultural soils.

Since there had been no county soil surveys in the lower coastal plain since the Jones County study of 1934, the Duplin County survey was begun in July, 1949. E. F. Goldston was named to head a staff comprised of J. M. King and W. W. Stevens of S.C.S., W. S. Ligon and A. H. Hasty of the Division of Soil Survey, and W. D. Lee of State College.

The information being obtained in the Duplin study will be useful (1) in drawing up soil conservation plans for individual farms; (2) in determining location and extent of wooded areas that can be brought into agricultural use; (3) in setting up drainage districts; and (4) in planning research for the area, particularly at the vegetable research center recently established at Faison.



The machine used for applying radioactive fertilizers in experiments.

Machine for Placing Radioactive Fertilizer

A machine for placement of radioactive phosphate as well as differential placement of commercial fertilizers has been designed and built by R. W. Wilson and E. N. Scarborough in cooperation with W. C. Hulburt of the U. S. Department of Agriculture. The machine is used by research workers to study the uptake of radioactive phosphate by plants and to measure the efficiency of differential placement of fertilizer in cotton, corn, tobacco and small grain.

It is capable of placing the radioactive phosphate in any or all of the following positions: directly with the seed; mixed in the drill; and in bands, 3, 9 and 15 inches from the drill at varying depths on either or both sides of the drill. The nitrogen and potash can be placed simultaneously in bands on either side of the drill from a top delivery hopper. It is also possible to bed and plant at the time of operation.

This machine was mounted on a small tractor, and the soil working tools were operated by the hydraulic unit of the tractor. The belt hoppers were equipped with heavy plastic covers to shield the operator and observers from the harmful rays of the radioactive material.

Although the machine performed satisfactorily during 1949, it will be entirely rebuilt as a more compact trailing unit that will be adaptable to the varying terrains and soils conditions in the State.

Vary Sidedressing Method with Crop

A series of experiments in which corn, cotton and tobacco plants were fertilized with radioactive-tagged superphosphate has clearly demonstrated that the same method of sidedressing will not work equally well on all crops.

Three methods of placement were tested on each crop by a research team under the leadership of N. S. Hall. With one method, the fertilizer was placed three inches to the side and two inches below the seed level. In the second, it was placed nine inches to the side and three inches below, and in the third, 15 inches to the side and four inches below. Root samples were then drawn periodically during the growing season and tested for their radioactivity.

Table 1 shows the activity of corn roots expressed as a percentage of what it was 20 days after planting. Activity of the roots which had received the fertilizer three inches to the side and two inches below the seed level reached a maximum at three weeks. Then it declined to about 30 per cent at the tasseling stage. The root activity in the two outer zones at tasseling was three times what it was at three weeks. In both outer zones, activity increased steadily during the growing season.

Experiments with cotton gave

quite the opposite results. As seen in Table 2, cotton receiving fertilizer in the two outer zones showed no root activity until two and three months after planting. As in the case of corn, the activity in the three-inch zones goes through a maximum and then declines. The overall change in this zone is not nearly as great, however, as in the case of corn.

The tests with tobacco showed that the tobacco plant does not utilize phosphorus placed nine inches to the side of the row and three inches below the original ground level. In fact, the fertilizer was much more effective when all of it was placed in two bands—one on each side of and close to the rows—than when placed in four bands. The increased response was comparable to that when the rate of fertilization was increased from 40 to 80 pounds. The results strongly suggest that the two outer bands of phosphorus were being utilized.

The investigators conclude that in the case of cotton and tobacco, it is best to stay within nine inches of the row when applying fertilizer. With corn, the middle of the row is the most efficient location. The reason for these differences, says Hall, is that the fertilizer must be placed where the roots are actively absorbing.

TABLE 1. The activity of corn roots in three zones relative to the activity at three weeks

Zone	Relative activity (%) at days after planting			
	13	20	33	50
1. 3" to side and 2" below seed level.	7	100	79	37
2. 9" to side and 3" below seed level.	22	100	250	310
3. 15" to side and 4" below seed level.	29	100	100	330

TABLE 2. The activity of cotton roots in three zones relative to the activity at three months

Zone	Relative activity (%) at days after planting					
	17	30	43	59	73	90
1. 3" to side and 2" below seed level.	29	96	160	160	120	100
2. 9" to side and 3" below seed level.	0	0	0	0	82	100
3. 15" to side and 4" below seed level.	0	0	0	0	0	100

DRAINAGE INVESTIGATIONS CONTINUE AT PLYMOUTH

Drainage improves drainage. Yes, that's the finding of J. F. Lutz and C. E. Scarsbrook in two drainage experiments—one at Bethel and the other at Plymouth.

The movement of excess water—that is, drainage—is determined largely by the number of large pores in the soil. Lutz and Scarsbrook found that ditching and tiling greatly increased the percentage of large pores.

Ditching and tiling removed some of the excess water, even from the heavy clay subsoils in these tests. This was accompanied by shrinking and cracking of the soil, thus affording better aeration. Plant roots grew better, and when they died and decayed, they left channels which, in turn, gave better drainage and aeration.

The total pore space and the percentage of large pores was increased, thus making the soil less compact and easier to work.

According to E. G. Diseker, the drainage systems giving the most efficient drainage at the Bethel station were tile at three foot depth, open ditches at three foot depth, blasted ditches at three foot depth and tile at two foot depth. All gave good drainage at Plymouth.

This crop drying building on the farm of Lloyd Wilson near Lowndale was designed for hoy, small groin, seed corn, soybeans and cotton.



Same Barn Used to Dry Several Crops



Nearly 2,000 bushels of sweet potatoes were cured and stored for five months in this building at a cost of 9½ cents per bushel for fuel oil.

Alfalfa hay, seed corn, small grain and sweet potatoes were among the crops dried or cured successfully during 1949 in a crop drying building designed by J. W. Weaver, S. H. Usry and N. C. Teter.

The engineers found that baled alfalfa can be dried in the building

for an average operating cost of \$3.80 per ton. The cost for drying seed corn was about 8 cents per bushel, and for small grain it was about 10 cents per bushel. The building was filled with 2,000 bushels of sweet potatoes which were cured at 85 degrees F. for 10 days and stored at 55 degrees for five months. The operating cost for both curing and storage totaled 9½ cents per bushel.

Farmers are already successfully adopting the general purpose drying barn. Lloyd B. Wilson of Lowndale erected for \$4,000 a building similar to that in which the above experiments were conducted. An apple storage house was converted for drying by Lee Hill of Hendersonville at a cost of \$1,200.

Agricultural engineers of the Duke Power Company who worked with Wilson and Hill on the operation of their driers report drying costs of \$1.72 per ton for baled hay and 11½ cents per bushel for small grain and seed corn.

Certain changes will be made in the design of the drying building at the Experiment Station for the 1950 drying season. Improvements in the operation and efficiency of the drier are expected.



SOCIAL AND ECONOMIC PROBLEMS

Wake Survey Links Health, Environment

Numerous surveys have shown that the rural people of North Carolina have more illnesses and get less medical care than do urban people. A 1949 survey in Wake County confirmed this fact and further indicated that the health problems of rural people are due, in part, to a poorer home environment.

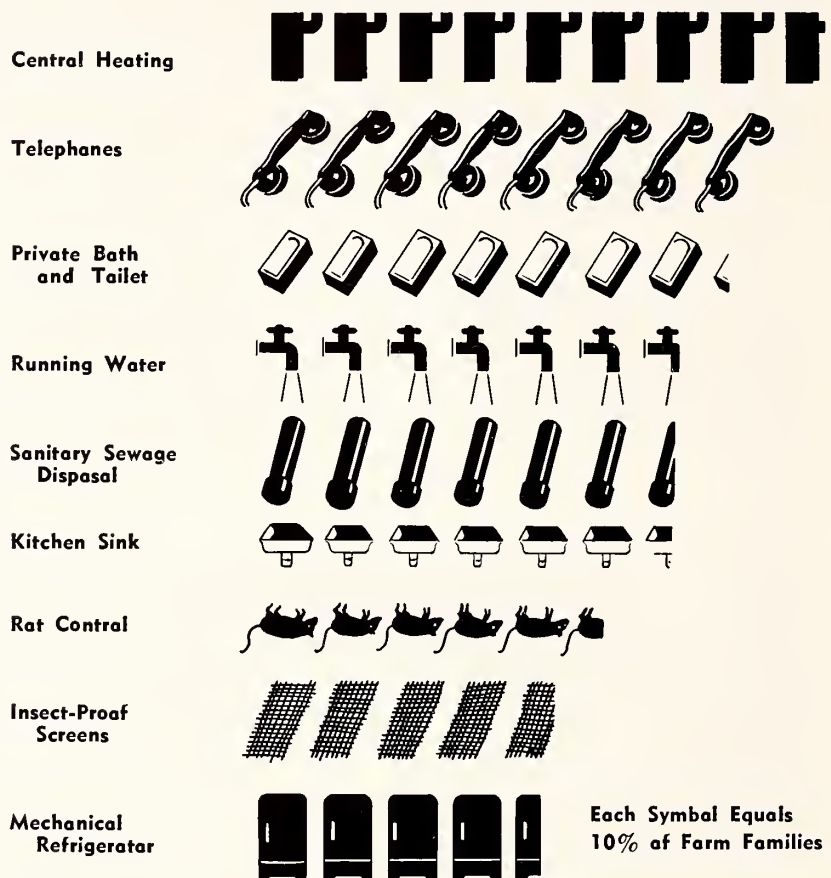
In this survey, directed by C. Horace Hamilton, one out of every 50 households in Wake County was surveyed. The health environment of each family was measured by means of a 23-point scale. The score was based on housing, sanitation and home conveniences such as heating and plumbing which are most closely related to maintenance of good health.

Using the scale on a percentage basis with 23 points equal to 100 per cent, the average score for Wake County families was found to be 74 per cent. As may be seen from the accompanying table, the health environment scores for rural-farm families was only 58 per cent while that for the urban (Raleigh) families was about 83 per cent. Differences by race and tenure groups ranged from a high of about 95 per cent for urban white home owner families to a low of only 35 per cent for rural non-farm Negro renter families.

Hamilton reports the following as the most serious deficiencies in the health improvement of rural-farm families in Wake County: almost nine families out of ten had no central heating system, eight out of ten had no telephone, 68 per cent did not have running water, almost three-fourths had no private bath and toilet, 67 per cent had no sanitary sewage disposal, two-thirds had no kitchen sink, 56 per cent did not have rats and insects under control, 45 per cent did not have a mechanical refrigerator, a similar percentage had no safe water supply, and 28 per cent did not average one bedroom for each two people.

Even with net incomes averaging less than \$1,500, Wake County

Farm Families Do Not Have—



farm families were spending a higher percentage of their incomes for medical services than were families with higher incomes. For instance, rural-farm tenants with a median family income of only \$1,147 were averaging \$107 or 9.3 per cent of the income for medical care. Rural farm owners with a median family income of \$2,444 were paying \$181, or 7.4 per cent, for medical care.

Voluntary health insurance has

not yet become effective among farm families of Wake County, Hamilton reports. Only 28.7 per cent reported any kind of health insurance. In contrast, 75 per cent of Raleigh families carried insurance.

As a result of low incomes and lack of health insurance, the farm people of Wake County receive less than half as much dental service and eye examinations and less than a third as many health examination as do urban people.

Health Environment Percentage Scores of Wake County Families by Residence, Color, and Tenure

Color and Tenure	Residence			
	Total	Urban	Rural-nonfarm	Rural-farm
Total	74.0	82.7	73.8	58.0
Owners	81.1	89.6	80.0	68.7
Renters	67.3	77.1	60.6	46.6
White families	80.9	90.4	78.5	65.7
Negro families	52.7	62.5	42.0	40.9

STUDY REVEALS FACTORS IN FARM LEADERSHIP

What characteristics are associated with farm leadership? Do age, race, sex, residence or other factors play a dominant part in developing leadership.

Because leadership is so important in rural development and because it has been missing from the rural scene so frequently, Selz C. Mayo undertook to answer these and other questions in a recent survey of two rural communities in Wake County. His study covered 1,400 rural people ten years or older living in 435 households.

Mayo defined leadership as the holding of an office or serving as a member on a committee in any organization such as church, school, farm organization, woman's club, 4-H or civic club. Hence, it was possible for one person to hold more than one leadership position. For the entire population studied, there was an average of 34 leadership positions per 100 population.

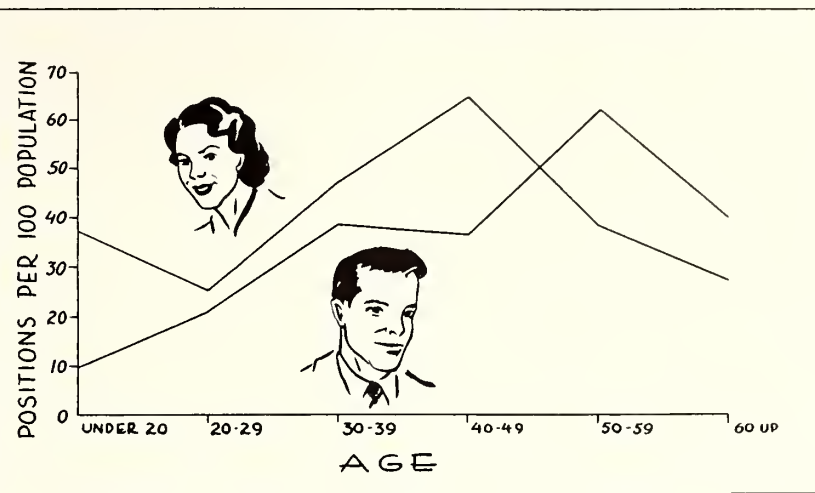
One of the most interesting findings as shown in the accompanying figure was the comparison between positions held by males and females. Women hold 39 and men only 29 leadership positions per 100 population. Before 50 years of age, women hold more leadership positions than men, while after 50, just the opposite is true. The peak in leadership for women comes between 40 and 50 years of age while the peak for men is between 50 and 60.

Leadership rates in one small rural village in the study were much higher than corresponding rates in the surrounding open country. In both village and open country the rates were higher for women than for men.

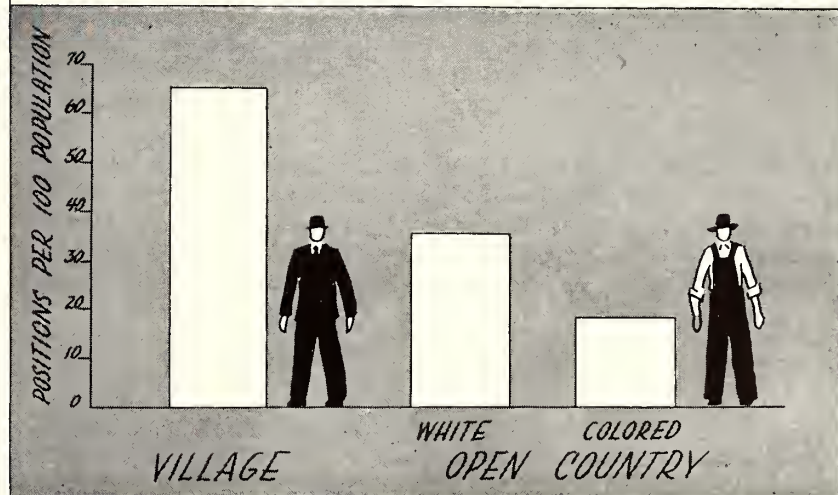
Leadership position rates in the open country were higher for Negroes than for white people and slightly higher for Negro males than for females. A high percentage of Negro leadership positions are found in connection with the rural church.

Mayo also found leadership rate to be associated with tenure status—partly because owners are usually older than tenants.

MEN VS. WOMEN AS LEADERS



LEADERSHIP: VILLAGE VS. OPEN COUNTRY



TVA Demonstrators Observe 15th Year

The acreage in row crops has been sharply reduced, acreages in sod and close-growing crops increased and the use of lime and fertilizers boosted since the Test Demonstration Program was started in 15 western North Carolina counties in 1935.

T. K. Jones and H. B. James conducted a study during 1949 to measure progress in the area after 15 years of test demonstration

work. Their data indicate that considerable progress has been made in conserving physical and human resources and in improving economic and social conditions.

More intensive farming systems utilizing livestock, higher crop and pasture yields, and rapidly growing dairy and poultry industries are evidences of progress. As incomes have increased, farm families have raised their standards of living.

Which Farmers Accept New Practices

Do improved farm practices make farmers more prosperous, or is it merely that prosperous farmers are better able to finance improved practices?

Perhaps no one can answer that question with finality, but Eugene A. Wilkening had determined that farmers with the highest "socio-economic" status are also the farmers who adopt the greatest number of improved practices.

Wilkening conducted a study among 107 farmers of Yadkin County, North Carolina. The socioeconomic status of each was measured by such factors as amount of land owned, farm income, participation in community affairs, amount of schooling completed and possession of household conveniences.

The farmers were asked which of nine improved farm practices they had adopted. These practices were: (1) use of hybrid corn in 1948; (2) use of more than 200 pounds of commercial fertilizer on corn at planting; (3) the seeding of improved pastures; (4) planting row crops on contour; (5) use of purebred cattle; (6) use of purebred hogs; (7) adopting a secondary source of income; (8) woodland improvements through

planting or thinning; and (9) keeping farm records.

A significantly higher proportion of farmers with "high" status than of those with "low" status had adopted the first seven of these practices. A higher proportion of those with "high" status had also adopted the latter two practices, but the differences were too small to be significant.

The greatest differences in rate of adoption by the two groups were for those practices requiring the longest time for expected returns. These include the use of purebred hogs and cattle and the seeding of permanent pastures. Differences in the rate of adoption were not so great for such practices as use of hybrid corn and increased fertilization which promise more immediate returns.

Wilkening concludes that improved socioeconomic status is both the *cause* and *result* of adopting improved farm practices. He suggests that improvement in farming has a cumulative effect. As the farmer increases his wealth, income and social contacts with the help of good farming practices, the more he is likely to adopt additional improved practices. The problem, says Wilkening, is how to get the "cycle" of improvement started.

STUDY MADE OF FLUE-CURED CO-OP

The organization, operation and accomplishments of the Flue-Cured Tobacco Cooperative Stabilization Corporation is the subject of a study being conducted by Morris W. Sills. The Corporation is a non-profit association organized by tobacco growers in 1946 as their agent in buying and disposing of tobacco under the price support program.

The Corporation has a membership of about 400,000 producers. It received about 5 per cent of the net producer sales of tobacco in 1946, about 18 per cent in 1947 and almost 10 per cent in 1948. Although its primary purpose is to

assure government loans to growers, the incorporators provided for any future operations in the field of marketing which the growers might wish to put into effect.

Any producer of flue-cured tobacco may become a member by buying one or more shares of common stock. Each member has only one vote in the affairs of the Corporation, regardless of how many shares of stock he holds. The organization is administered by a board of directors—three each from the Old and Eastern North Carolina Belts, two from the Border Belt and one each from the Middle and Georgia-Florida Belts.

Unit Demonstrators Keep Up Improvements

How effective is the Unit Test Demonstration Program as a means of permanently improving the level of farming? Do farmers continue to use recommended practices after they cease to serve as active unit demonstrators?

A study by J. C. Williamson of Western North Carolina demonstration farms made "inactive" in 1946 indicates that the level of farming has been maintained or improved since that date. Included as measures of the level of farming were farm organization, production practices and social and economic status of the farm family.

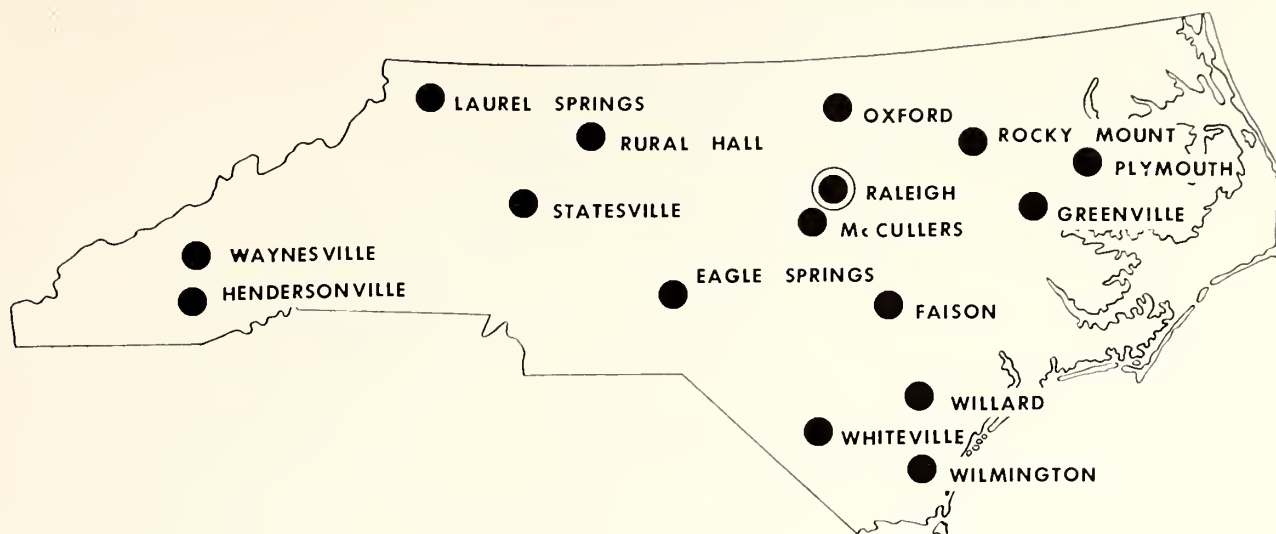
Each of the farmers included in the study had served as active demonstrators for five years or more. During this period, the Extension Service had made intensive efforts to provide these farmers with technical advice and assistance. In addition, they were provided with high analysis fertilizer materials by the Tennessee Valley Authority at considerably less than the market price.

In 1946 these farmers were "graduated" to the level of individual initiative—that is, services of the Extension Service were available through normal channels, and fertilizer materials could be obtained only at full price. It is a tribute to the Test Demonstration Program, says Williamson that these farmers have exercised their own initiative in maintaining and improving their level of farming.

Similar findings were made in a study of the extent to which Clay County farmers are following long-time agricultural programs. T. K. Jones and H. B. James found that Clay farmers are rapidly moving in the direction indicated by plans drawn up in 1946.

Higher corn yields, increased acreages of Ladino clover pastures and increases in poultry numbers were attained on all size farms. Field observations indicate that as incomes have increased, the people are living better. Homes are being made more attractive and conveniences added.

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FINANCIAL REPORT

of the

NORTH CAROLINA AGRICULTURAL EXPERIMENT STATION

For the Year Ended June 30, 1949

CERTIFICATION

We, the undersigned, certify that the receipts and expenditures shown in this report from Federal funds and as offset to Bankhead-Jones funds are correct; that the expenditures were solely for the purposes set forth in the acts of Congress approved March 2, 1887 (Hatch), March 16, 1906 (Adams), February 24, 1925 (Purnell), May 16, 1928 (Hawaii), February 23, 1929 (Alaska), March 4, 1931 (Puerto Rico), June 29, 1935 (Bankhead-Jones, Title I), June 20, 1936 (Alaska), and March 4, 1940 (Employer Contributions to Retirement); that the expenditures are in accordance with the terms of said acts so far as applicable to this station; and that properly approved vouchers are on file for all expenditures.

We further certify that the sum of \$(None) was the total amount earned as interest on the deposit of Hatch, Adams, Purnell, and Bankhead-Jones funds and that this amount has been remitted to the Treasurer of the United States through the United States Department of Agriculture.

(Signed) J. H. Hilton,
Director of Experiment Station

(Signed) J. G. Vann,
(Legal Custodian of Federal Funds)
Assistant Controller
North Carolina State College of
Agriculture and Engineering

(Seal of Institution)

Receipts and Expenditures

**Under Hatch, Adams, Purnell, Bankhead-Jones and under Sections
9(b)1 and 9(b)2 of the Research and Marketing Act**
Fiscal Year ended June 30, 1949

RECEIPTS

FEDERAL FUNDS:	Balance From 1948-49	Receipts From U. S. Treasury	Total
Hatch	\$ None	\$ 15,000.00	\$ 15,000.00
Adams	None	15,000.00	15,000.00
Purnell	None	60,000.00	60,000.00
Bankhead-Jones	None	123,766.51	123,766.51
Research and Marketing Sections 9(b)1 and 9(b)2.....	15,989.82	94,261.74	110,251.56
TOTAL	\$ 15,989.82	\$308,028.25	\$324,018.07

EXPENDITURES

PURPOSE	Hatch	Adams	Purnell	Bankhead- Jones	Res. and Mktg. 9(b)1-9(b)2
Personal Services:					
For all other purposes.....	\$11,197.24	11,371.15	47,299.44	98,276.76	64,319.46
Travel	774.96	134.71	3,770.46	2,325.19	3,060.11
Transportation of Things.....	17.04		36.97	321.29	123.62
Communication Service	100.00		327.62	424.42	310.48
Rents and Utility Services:					
Heat, light, power, water, gas, electricity			11.25	372.38	44.13
Rent of space in buildings and equipment				9.00	
Rent of land				55.00	
Printing and Binding:					
Printing publications.....	650.00			34.99	35.50
Other printing, and binding	144.02		136.00	249.48	66.44
Other Contractual Services:					
Repairs and alterations to equipment, and other contractual services not otherwise classified	549.91	1,393.46	272.15	3,169.87	1,053.91
Repairs and alterations to buildings (not capital im- provements)					654.76
Supplies and Materials:					
Used in construction, re- pair, or alteration of buildings	1,147.57	639.43	5,170.30	10,071.64	8,943.88
Equipment	419.26	1,461.25	2,975.81	4,346.49	16,879.16
Lands and Structures (Con- tractual):					
Other structures (pur- chase, construction, and repair)				2,110.00	
TOTAL EXPENDITURES	15,000.00	15,000.00	60,000.00	123,766.51	95,491.45
Unexpended Balances June 30, 1949	None	None	None	None	14,760.11
Required Bankhead - Jones and Research and Mar- keting 9(b)1 and 9(b)2, Allot- ment Offsets					
Total Approved Expendi- tures, Non-Federal Funds					871,735.57

Non-Federal Funds

Fiscal Year Ended June 30, 1949

Funds Available

	For all Purposes	For Agricultural Investigations
State appropriations or allotments:	\$759,109.65	\$738,249.84
Main station	82,962.35	82,962.35
Sales (Misc. receipts)	50,523.38	50,523.38
Miscellaneous (Commercial Gifts)		
TOTAL	892,595.38	871,735.57

Classification of Expenditures

For

Agricultural Investigations

Personal Services	\$ 601,624.70
Travel	22,816.39
Transportation of Things	3,066.64
Communication Service	6,519.75
Rents and Utility Services	10,278.07
Printing and Binding	11,519.39
Other Contractual Services	30,767.39
Supplies and Materials	92,201.57
Equipment	76,718.33
Lands and Structures (Contractual)	16,223.34
Contribution to Retirement	
Total Expenditures	871,735.57
Unexpended Balance	
Total Funds Available	871,735.57

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